American Foundryman

THE FOUNDRYMEN'S OWN MAGAZINE

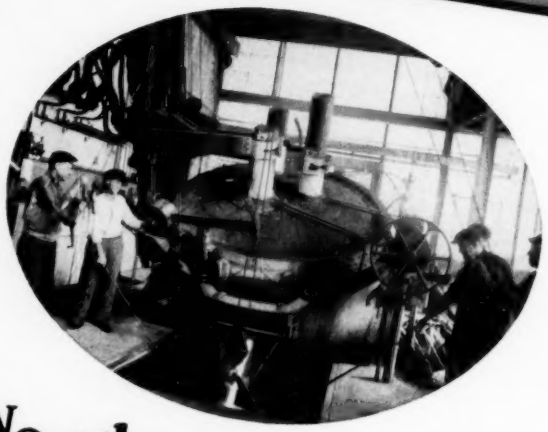
JULY 1950

31

years ago:

McQuay-Norris

said...



No other Piston Ring has Metal like this

To improve on cupola-melted piston ring metal, the McQuay-Norris Manufacturing Company has changed all old established iron foundry practice. They have applied to piston ring manufacture the same method that has revolutionized the making of high-grade alloy steels—the Electric Furnace—the only one used in this country today for melting commercial gray iron. This improvement places McQuay-Norris Rings in still another class by themselves.

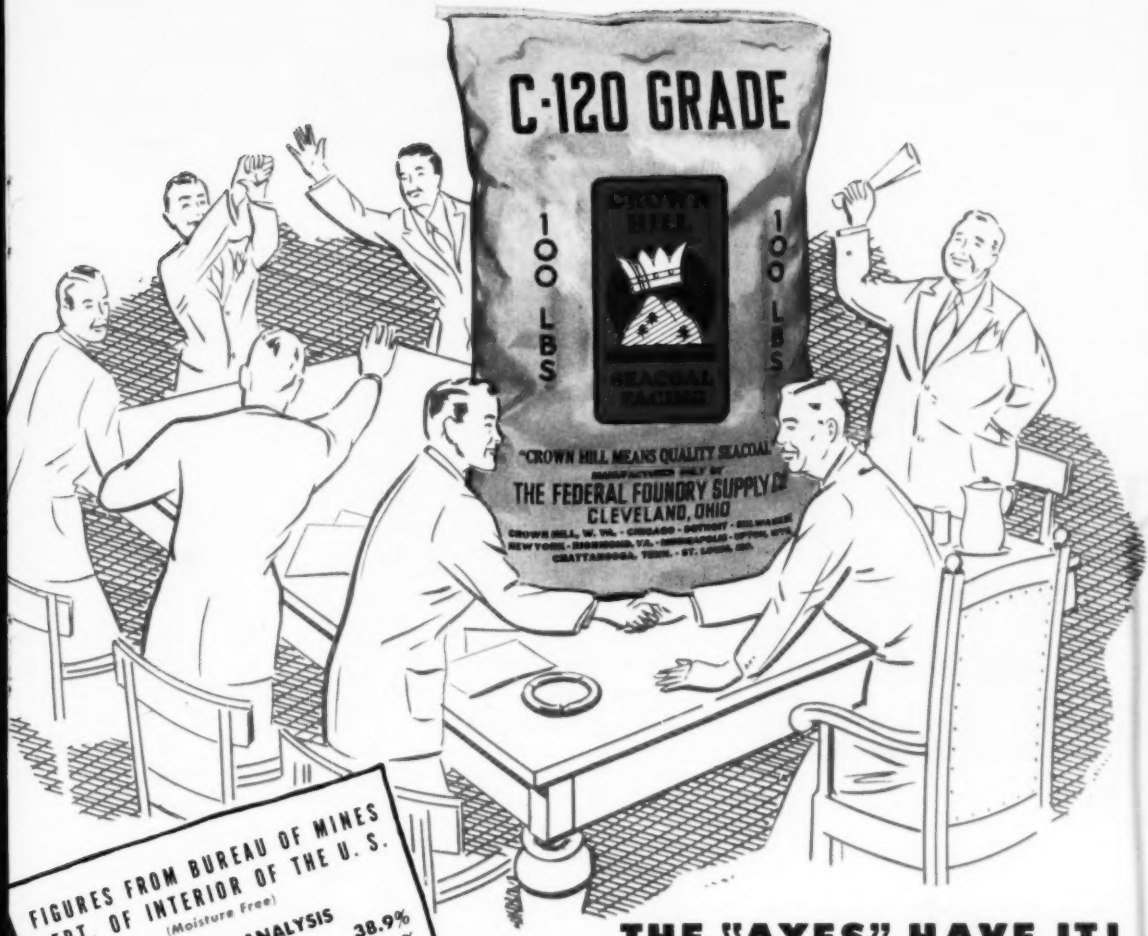
Written 31 years ago, that story is just as factual today: The accurate control possible with an electric furnace, the closer grain structure obtained at the higher temperatures, the greater uniformity possible; all result in better castings.

McQuay-Norris now has two Lectromelt Furnaces. That 3-ton furnace bought in 1919 has been modernized with Lectromelt electronic controls and other refinements. The second, installed in 1943, will do almost as much work as the old-timer although it's rated at half the capacity. It is top charged, rather than door charged.

If you're interested in learning what a Moore Rapid Lectromelt Furnace will do for you, write Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in... CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2... ENGLAND: Birlec, Ltd., Birmingham... SWEDEN: Birlec Elektkougnar A/B, Stockholm... AUSTRALIA: Birlec, Ltd., Sydney... FRANCE: Stein et Roubaix, Paris... BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege... SPAIN: General Electrica Espanola, Bilbao... ITALY: Forni Stein, Genoa.

WHEN YOU MELT... MOORE RAPID *Lectromelt*



FIGURES FROM BUREAU OF MINES
DEPT. OF INTERIOR OF THE U. S.
(Moisture Free)

PROXIMATE ANALYSIS	
Volatile Matter (V.C.M.)	38.9%
Fixed Carbon	57.4%
Ash	3.7%
	100.0%

ULTIMATE ANALYSIS	
Hydrogen	5.4%
Carbon	82.0%
Nitrogen	1.6%
Oxygen	3.6%
Sulphur	.7%
Ash	3.7%
	100.0%
Fusion Point of Ash	2,780° F.

THE "AYES" HAVE IT!

Easy to see why more and more foundries use Crown Hill Seacoal Facing made by Federal. Records prove the advantages. It vents in a flash, eliminates hard spots in castings caused by sulphur pick-up and cuts cleaning costs.

Crown Hill means quality seacoal. Try it! See for yourself why foundries from coast to coast specify Crown Hill Seacoal Facing made by Federal.

THE FEDERAL FOUNDRY SUPPLY COMPANY

4600 East 71 Street • Cleveland 5, Ohio

Seacoal Plants
CROWN HILL, W. VA. • CHICAGO • CHATTANOOGA, TENN. • DETROIT • MILWAUKEE • NEW YORK • ST. LOUIS • RICHMOND, VA. • UPTON, WYO.

SAVED IN AS LITTLE AS 18 DAYS*

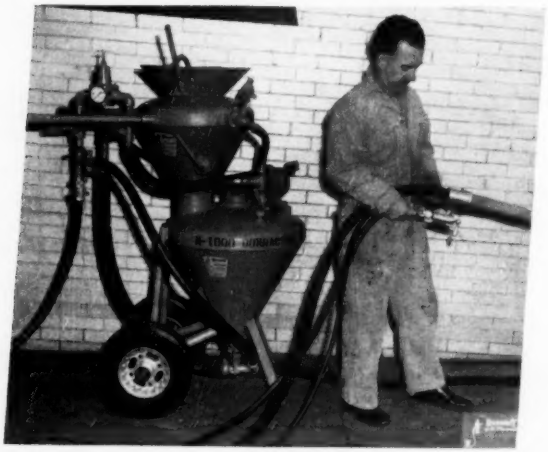
OF BONDACTOR

*Actual case for large foundry. Small foundries say 35-50 days.

ENTIRE FIRST COST

FOUNDRIES REPORT

The Bondactor will save you money in cupola patching by reducing refractory loss and patching time. In one large foundry, this saving has been sufficient to pay for the equipment in less than one week. In smaller foundries, the savings range from $5,000 to $35,000 per year. The BONDACTOR equipment is now used in 156 foundries with outstanding success. Service records cover over 18 months of hard operation without a single reline of the cupola. Over the past forty years, attempts to "gun" patch have previously failed, but 156 satisfied foundries now prove that the BONDACTOR can and will do the job to your complete satisfaction — or your money back.



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JACKSON, OHIO

DIXIE BOND • BLACK HILLS BENTONITE
REVIVO BOND • REVIVO SUPER BOND
BALANCED REVIVO

E C P

BONDING CLAYS and EXCEPTIONAL FOUNDRY SERVICE

Since 1926

BONDACTOR EQUIPMENT • CUPOLINE REFRACTORY • DURA PRODUCTS

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VOLUME XVIII, NUMBER 1

American Foundryman

July, 1950

Official publication of American Foundrymen's Society

Editorial: Participating in A.F.S. Committee Work: R. G. McElwee

A.F.S. Chapter Officers Meet in Chicago

Mineral Perlite—Foundry Uses: E. D. Boyle

Plan Regional Foundry Conferences

President's Annual Address: Edwin W. Horlebein

French Foundry Management: J. M. Laine

Technical Correlation Committee Meets

Modern Foundry Methods: Unusual Casting Methods

IBF Annual Conference

A.F.S. Foundry Glossary (Part I)

Burning-In the Cupola Bed: B. P. Mulcahy

Old Timers Attend 54th A.F.S. Convention

Apply Radioisotope—Cobalt 60—To Radiography of Castings: H. R. Isenburger

Precision Aluminum Castings: Hiram Brown

Establish Foundry Controls Through Laboratory Services

Nodular Iron—A Bibliography: F. R. Morral

Southern California's Foundry Essay Contest: E. K. Smith

Who's Who

New A.F.S. Members

Foundry Personalities

Chapter Officers and Directors

Chapter Activities News

Foundry Literature

New Foundry Products

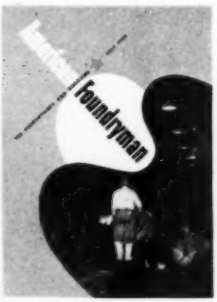
Foundry Firm Facts

Abstracts of Technical Articles

Advertisers' Index

A.F.S. Employment Service

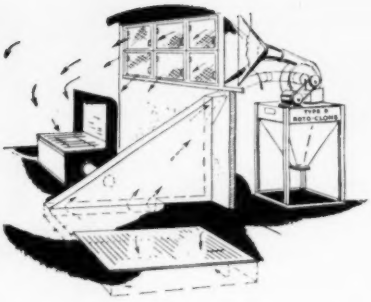
The American Foundrymen's Society is not responsible for statements or opinions advanced by authors of papers in its publication.

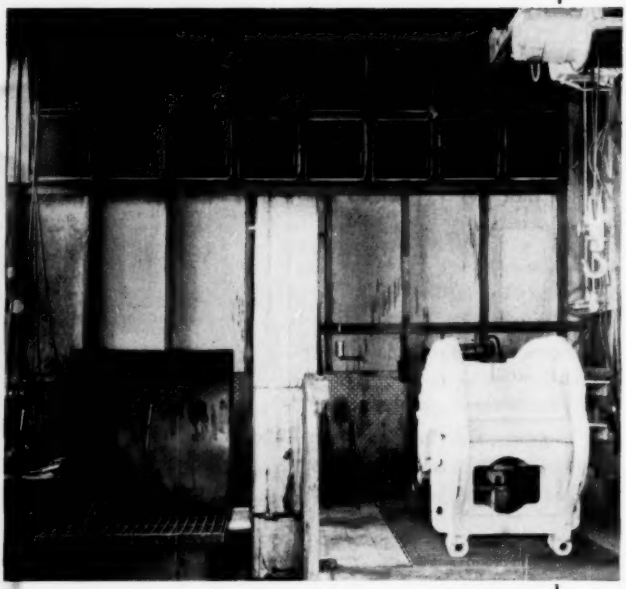


Engine block line at Buick Motor Div., General Motors Corp., Flint, Mich., has moving platform and monorail-supported, power-driven ladles synchronized with mold conveyor for rapid, controlled pouring. Hoods at left remove any fumes or odors developing from molds and cores.

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subscription price in the U. S., Canada and Mexico, $3.00 per year; elsewhere, $6.00. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago, Illinois. EASTERN REPRESENTATIVE—Warren Thomson Mayers Co., 130 East 61st St., New York. CENTRAL REPRESENTATIVE—Frank J. Enright, 16718 Kenyon Road, Cleveland. MIDWESTERN REPRESENTATIVE—L. F. McClure & Associates, 814 N. Tower Court, Chicago.

ROTO-CLONE
solves "twin" dust problems





HERE'S a potential dust storm that never materialized. Pictured at left are "twin" grinding operations for finishing both small and large castings. Double Trouble? Not a bit—the combined dust load is handled efficiently and economically by a Type D Roto-Clone*.

Now examine the drawing above. Note how the dust-laden air is drawn from both the down draft bench and floor grating into a common plenum chamber and then into the Roto-Clone. Dust is discharged into the hopper and the air is exhausted through a bank of AAF Type M/W-4 viscous unit filters for final cleaning before recirculating to the working area.

The simplicity and efficiency of Roto-Clone equipment enables you to apply positive dust control to more operations at lower cost. An AAF engineer will be glad to analyze the dust-producing operations in your foundry or plant and show you how Roto-Clone can solve your problem at a saving. Call your local AAF representative today or write direct to

AMERICAN AIR FILTER COMPANY, INC.
104 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P.Q.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

**Roto-Clone is the trade mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydrostatic precipitator types.*

AAF

ROTO-CLONE®
DUST CONTROL EQUIPMENT

"HIGH SPOT" OF 1950 FOUNDRY SHOW

Means More Profits To You

A crowd-collecting feature of the recent Foundry Show was the demonstration of the Croning Process in Bakelite's Exhibit. This new process for making foundry molds and cores combines the advantages of increased production, reduced cost, and improved quality of the casting. It uses BAKELITE Phenolic Resins as binders for the foundry sand. Crown Casting Associates, 75 Federal St., Boston, own and control U. S. and Canadian patent applications for the process and are granting licenses to users.

These are some of the advantages of the process: Clean, smooth castings are produced which require little or no finishing such as shot-blasting or other abrading; tolerances of .002 to .003 of an inch are common practice; floor space productivity is greatly increased.

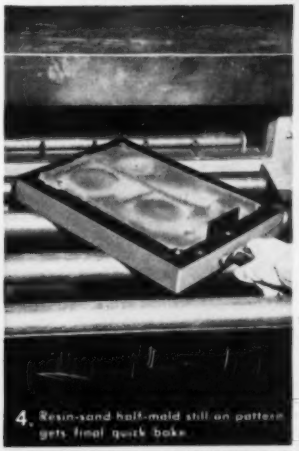
Because Croning Process molds and cores are strong, although thin-walled shells, they provide a saving of up to 90 per cent in the amount of sand that would be required for heavy conventional sand molds and cores. BAKELITE Phenolic Resin bond contributes the necessary strength and moisture resistance to permit storage of molds and cores for future production. Baking of these molds and cores requires only a few minutes, not hours.

It will pay you to write today to Dept. AT-39.

1. Pouring BAKELITE Resin-sand mixture into mold-making machine.

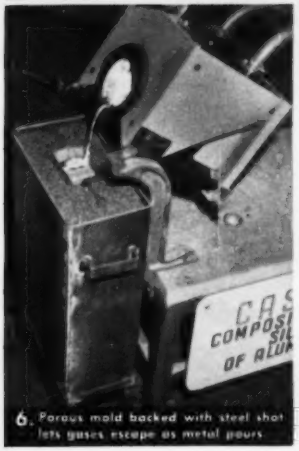
2. Hot pattern is clamped on face of mold-making machine.

3. Machine inverted: mixture fuses into thin half-mold on pattern.



4. Resin-sand half-mold still on pattern gets final quick bake.

5. Two thin half-molds clamped together form finished mold.



6. Porous mold backed with steel shot lets gases escape as metal pours.

7. Mold is easily broken away, leaving casting free of sand.

Bakelite TRADE-MARK *Phenolic* **BONDING RESINS**

BAKELITE DIVISION UCC

BAKELITE DIVISION
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N.Y.

How to get finer Cores in 4 easy lessons:

GET MORE GREEN STRENGTH — *use Krause cereal binders*

IMPROVE FLOWABILITY AND TEXTURE — *use Krause cereal binders*

PRODUCE FINER DETAIL — *use Krause cereal binders*

GET EASY BURN-OUT, COLLAPSIBILITY — *use Krause cereal binders*

Yes — the qualities you need and want are yours in Krause's Cereal Binders — TRUSCOR (light weight) and AMERIKOR (heavy weight).

So why not take advantage of all these benefits by placing your next order with any of the distributors listed below or with us direct.

CHAS. A. KRAUSE MILLING CO., Milwaukee 1, Wisconsin
World's Largest Millers of Dry Corn

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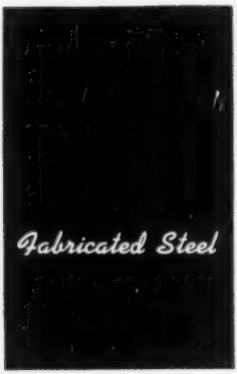
INSURE PRECISION . . .
SPEED-UP PRODUCTION

• Twenty years have proved the welded steel flask. Millions of castings in foundries the world over have been poured . . . perfectly. That's because welded steel won't shift so easily, permits far greater precision, stands up under hardest conditions.

BS&B developed the welded steel flask . . . pioneered the steel-bushed flask. Now even the most exacting job moves faster because of the ease of working with the strong, sturdy steel flask. Far easier to handle, too . . . they are so much lighter.

No matter the metal, regardless of close tolerance, BS&B Flasks mean better castings, faster!



BUILT
for the Foundry
by Foundrymen!

Yes, sir . . . every step in the manufacture of BS&B Flasks is controlled by FOUNDRYMEN. It is the skill and experience of such men that have led to so many improvements in material and method. For instance, the pinlugs pictured at the right. Just a simple reversal of the upper, and the foundryman has plenty of room for his fingers . . . the pinlug serves as a handle. Such planning, combined with manufacturing skill, is why BS&B Flasks do not require stress-relieving or normalizing, and will not warp under even extreme conditions of use.

BS&B Pre-Sells Your Customer!

We advertise you every time we advertise in STEEL, IRON AGE and PURCHASING. Our ads are addressed to the buyer of castings . . . selling him on your skill and precision with BS&B Flasks. It's another BS&B service!

Call your nearest BS&B DISTRIBUTOR TODAY

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"BIBLE"
Yours without cost! Complete catalog, fact book, handy reference.

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• Please send your leather-bound, loose-leaf "Foundry Flask Bible", the pocket-sized fact and figure book. ☐ Have a Sales Representative call. No obligation, of course.

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FIRM _____

ADDRESS _____

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Coke plant producing high quality metallurgical coke purchased by **Great Lakes Carbon Corporation**

Customers of former Laclede Gas Light Company Coke Plant, St. Louis, Mo., are assured of steady supply of coke and other products

We are pleased to inform the trade of our purchase from the Laclede Gas Light Company of its well-known St. Louis Coke Plant. We will, of course, continue to meet the supply requirements of the plant's customers.

The Coke Plant has 56 Koppers ovens and 8 Piette ovens capable of producing some 250,000 tons of high quality metallurgical coke a year. Other products consist of coal tar, ammonium sulphate, nitration and industrial pure grades of benzol, toluol, zylol, crude light and heavy solvent, and crude still residue.

The plant's production will be continued under the direction of Mr. E. W. Blind, superintendent; Mr. John Adolphson, assistant superintendent, and Mr. Joseph Kohlberg, chief chemist. We take considerable pleasure in informing you that these men, who have been with the plant many years and who are well-known throughout the industry, will remain with us and continue in their former capacities.

Great Lakes Carbon Corporation has been identified with coke and coal operations for more than 30 years. We are regarded as one of the largest and most dependable suppliers of calcined petroleum coke in the world. The products of the St. Louis Coke Plant are exceptionally well related to our other activities. We look forward to serving the plant's customers, many of whom are already acquainted with our other products.

GLC **Great Lakes Carbon Corporation**

NEW YORK • CHICAGO • LOS ANGELES • *Executive Offices:* 18 EAST 48TH STREET, NEW YORK 17

CARBON DIVISION

Petroleum coke
Calcined petroleum coke
Industrial carbons

OIL AND GAS DIVISION

Crude petroleum and natural gas

BUILDING PRODUCTS DIVISION

Lightweight aggregates for plaster and concrete, marketed under the registered trade name PERMALITE

ELECTRODE DIVISION

Graphite and amorphous carbon electrodes. Graphite anodes. Carbon and graphite specialties.

DICALITE DIVISION

Diatomaceous silica marketed under the registered trade name DICALITE

for **1.** Assured Core Support **2.** Maximum Fusion **3.** Freedom From Leakers **4.** Accurate Wall Thicknesses **use**

The ALL-NEW GROOVESTEM

FEATHEREDGE FUSION RINGS

Knife-like multiple Rings heat instantaneously to fusion temperatures—burning in and eliminating leakers.

COMPLETE CONTACT RADIUS GROOVES

Molten metal lays up solidly against the rounded bases of the radius grooves. Greater chaplet area contact results in maximum fusion. No sharp threads to trap gases or weaken stem strength.

COUNTERSUNK SHOULDERS

Heavy tapered shoulders provide solid support to plates—allow full contact with molten metal. No sharp angles to create voids usually formed under heads of ordinary chaplets.

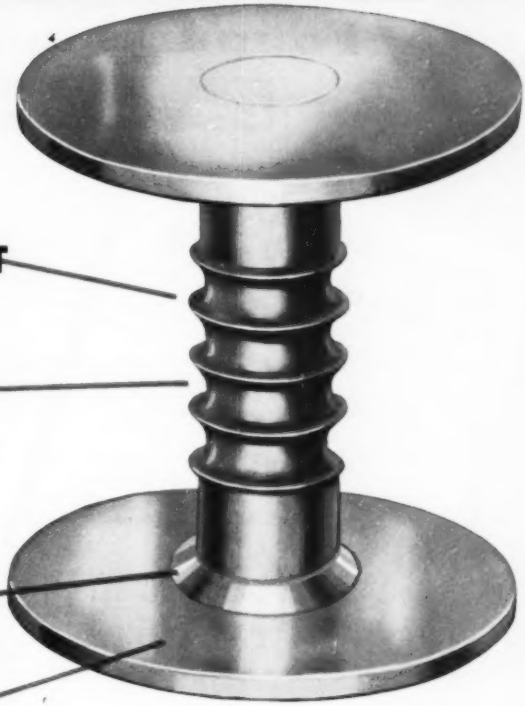
PURE TIN COATING*

Not only the surest known protection against rust, but actually an aid to fusion. Tin readily alloys with iron or steel lowering melting point, thus improving fusion.

PRECISION TOLERANCES

Held to plus or minus .002 on most sizes, Fanner reputation for accuracy is unequalled.

*Also available in pure copper



Patent Pending

For 56 Years Fanner Chaplets have been the standard of excellence in the foundry industry. In an effort to produce an even better chaplet, The Fanner Manufacturing Company commissioned the Battelle Memorial Institute, Columbus, Ohio, to conduct exhaustive studies of chaplet design. Based on these studies, supplemented by field tests in leading foundries, Fanner Manufacturing Company has developed the new Groovestem chaplet and has redesigned the Famous Superstem, further insuring the maximum in core support and completeness of fusion.

FANNER MFG. CO., CLEVELAND 1, OHIO

In Canada: CANADIAN FANNER, LTD., Hamilton, Ont., Canada

American Foundryman

Compounded to Stand the Test

HOLD THAT SAND!...

WITH AMAZING NEW SAND ARRESTER TUBE!

(Patent Applied For)

POSITIVELY ELIMINATES SAND STEMS ON BLOWN CORES!

- GUARANTEED FOR MORE THAN 100,000 BLOWS.
- AUTOMATICALLY DELIVERS PERFECT CORES
- APPROVED BY THE MOST EXPERIENCED FOUNDRYMEN
- INSTALLS WITHOUT SPECIAL TOOLS.
- SIMPLE TO INSTALL—PUSH OUT THE OLD—PUSH IN THE NEW
- SPECIAL QUALITY, WEAR RESISTANT RUBBER—NOT AFFECTED BY AMBA-TION OR WATER OF TIME
- TOUGH ELASTIC RUBBER FUSED TO SEAMLESS STEEL TUBES BY OUR OWN SPECIAL PROCESS.
- STEEL TUBE GREATLY PLATED AND RUST PROOF
- SAND FLOWS FREELY INTO CORE BOX.
- CORES, TIME and MONEY

...AID YOU SEE THAT THE TUBES ARE NOT WORTH ...L COUPON

MARTIN

ENGINEERING COMPANY

KEWANEE 9/13/49 ILLINOIS

Mr. John D. Murray, Adv. Mgr.
American Foundryman
222 W. Adams St.
Chicago 6, Ill.

Dear Mr. Murray:

Enclosed is a schedule of advertisements that our company has decided upon for American Foundryman. Frankly, we are very pleased with results to date. Coupons have been coming in consistently, and we are checking these carefully to gauge the market.

Of those received so far, American Foundryman has a distinct edge in the number of inquiries, with the advantage of an average ratio of 2 to 1 in sales over other publications.

It is on this record that we have decided to expand the schedule, per the enclosed.

Very truly yours,

MARTIN ENGINEERING COMPANY

E. F. Peterson

E. F. Peterson, Pres.

EFP/th

There is no mistaking results and, from the tone of the letter reproduced here, there is no mistaking the fact that AMERICAN FOUNDRYMAN, judged in terms of results, is the leading sales producer for the marketing of foundry equipment and supplies.

Yes, you've seen this advertisement reproduced in the pages of media reaching the foundry field, and you will be interested to know that the advertiser has kept a close tally on returns. The outcome was conclusive . . . AMERICAN FOUNDRYMAN **outpulled other magazines 2 to 1** in completed sales! This can mean only one thing—AMERICAN FOUNDRYMAN is the magazine that manufacturers can depend upon for results . . . **the kind of results that mean profitable advertising.**

AMERICAN FOUNDRYMAN can "pull" equally as many returns for those firms whose products are suited for use by the thousands of subscriber-members who regularly look to **The Foundrymen's Own Magazine"** as a reliable source of information on the development and production of cast metals.

If AMERICAN FOUNDRYMAN isn't already scheduled for your 1949-50 sales program, it is only **good business** to do so immediately—it costs less than 2c per prospect to reach the readers of AMERICAN FOUNDRYMAN each month with an ad similar to the one reproduced above. Send for full details today!

...an Foundryman

616 S. Michigan Ave.,
Chicago 5, Ill.

NISILOY*

...A POWERFUL, POSITIVE INOCULANT

CUTS FINAL COST OF GRAY IRON CASTINGS

BENEFITS TO CASTING USERS

EXCELLENT MACHINING QUALITIES—The dense, gray, machinable structure secured with Nisiloy reduces machining time, tool wear, rejects and costs.

INCREASED WEAR-RESISTANCE—The formation and distribution of finely divided random flake graphite accomplished with Nisiloy assures highly improved resistance to wear.

IMPROVED TOUGHNESS—Nisiloy acts to eliminate hard, chilled areas in thin and thick sections alike . . . thus, the casting is thoroughly machinable yet less sensitive to breakage in machining operations and general service.

DEPENDABLE PRESSURE-TIGHTNESS—The sound, homogeneous structure attained by inoculating with Nisiloy results in dense cast iron that provides substantially improved pressure-tightness.

BENEFITS TO FOUNDRYMEN

REDUCES REJECTS—Used for structure control of cast iron, Nisiloy helps your foundry meet daily schedules for uniform lots of machinable gray iron castings.

PROMOTES SOUND CASTINGS—Diffusing rapidly throughout the melt, Nisiloy promotes a dense, close-grained product.

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NO SCRAP PROBLEM—Containing only elements that dissolve freely in iron, Nisiloy permits remelting sprues and gates in any successive melt without risk of adding chill-forming elements.

FEWER BASE MIXTURES—Often a single base mixture may be used in the cupola to which Nisiloy is added in the ladle, with the consequent flexibility of pouring off thin or thick sectioned castings as desired.

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Company.....

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Mix with silica flour and water to produce finished wash.

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THERMOKOAT — It's Plasti-Lastic.
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NEW mechanical processing and improved chemical formulation . . . developed by DELTA Research . . . have resulted in many decided advancements in both the quality and characteristics of DELTA CORE and MOLD WASHES.

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a. Delta Core and Mold Washes "Anchor" themselves by penetrating from 10 to 12 grains deep into the sand. This bond between the wash and the sand . . . a distinctive DELTA characteristic . . . produces an expansion-resisting coating essential to the production of finer finished castings.

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The higher hot strength of DELTA Core and Mold Washes eliminates surface sand fissuring, excessive sand expansion and distortion.

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This Cupola Flux has a record of more than 32 years of success in casting improvement. It cleanses molten iron, makes it freer flowing, keeps slag fluid and reduces sulphur.

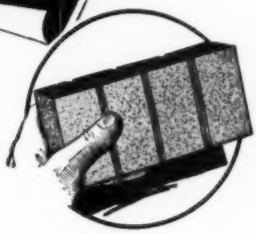
It has been, and continues to be, dependable insurance of sounder, cleaner castings, reduced rejects, and shops report definitely easier machining.

IT KEEPS CUPOLAS CLEANER, TOO. Bridging over is practically eliminated, drops are cleaner, life of lining is greatly prolonged, maintenance is greatly reduced.

MALLEABLE FOUNDRIES with Cupola Operation are not only giving their castings a better start with clean metal but are enjoying big savings in cupola maintenance. Famous Cornell Cupola Flux keeps cupolas cleaner. It reduces bridging over to a great extent, insures cleaner drops, and forms a glazed or vitrified surface on the brick or stone lining, which reduces erosion and prolongs the period between patching or replacement.

THE EXCLUSIVE SCORED BRICK FORM makes the fluxing operation very inexpensive.

Each brick is pre-measured, and all it takes is but a few seconds to lift it out of container and toss it into cupola with each ton charge of iron. Where charges of iron are smaller, you simply break off one to three briquettes (quarter sections) as per instructions.



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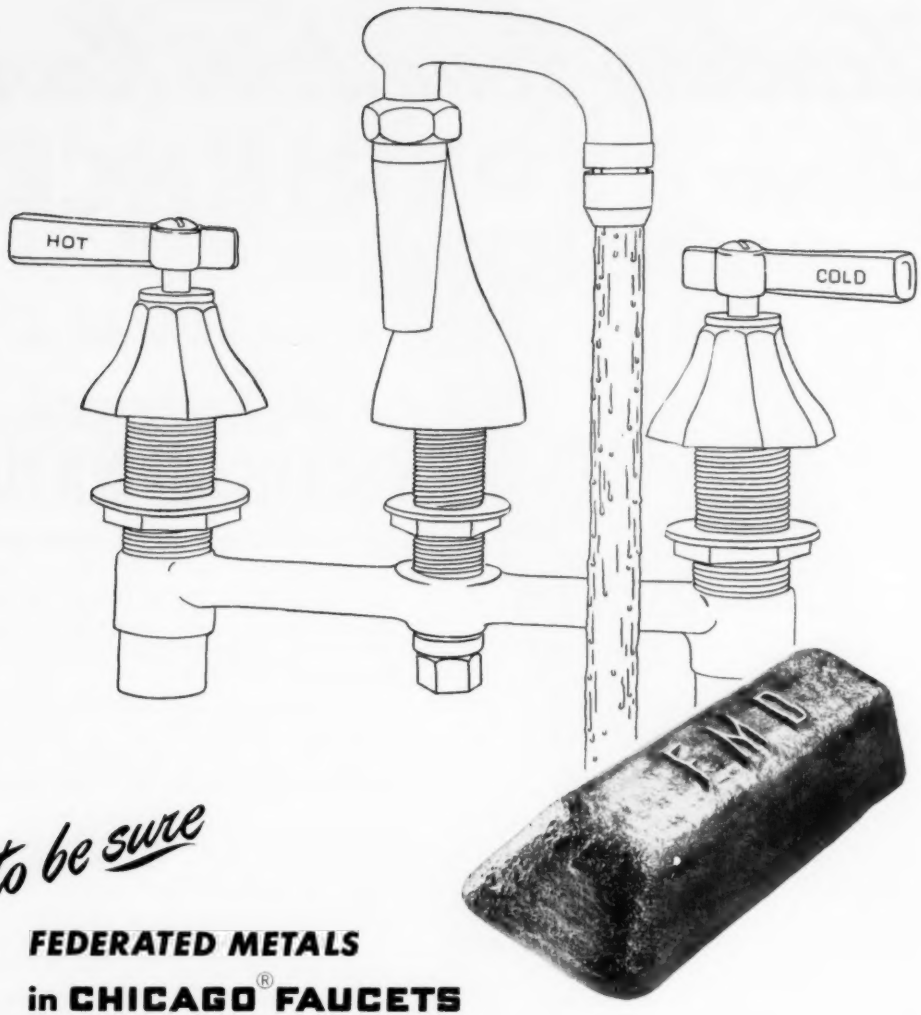

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The Chicago Faucet Company uses Federated copper-base casting alloys because they have found over the space of years that there is no substitute for the dependable metallurgical quality of Federated metals.

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Here's why BS&B Heavy Duty Welded Flasks won't break down at the bearing. Exclusive double welding prevents warp . . . provides a full-width bearing surface to evenly distribute the load. Two-piece construction allows use of THICKER and WIDER bearing . . . avoids cracked walls. Flasks available in following wall thicknesses—¼", 5/16", ⅜" and ½".

BS&B's extra bearing thickness delivers far longer service . . . and it can be machined at least four times to lengthen its life! Yes, since foundry men design and build BS&B Flasks, you can expect BS&B Flasks to be superior. Lighter weight, easier to handle, sharp precision, rugged construction, long production life . . . that's why you should employ BS&B.

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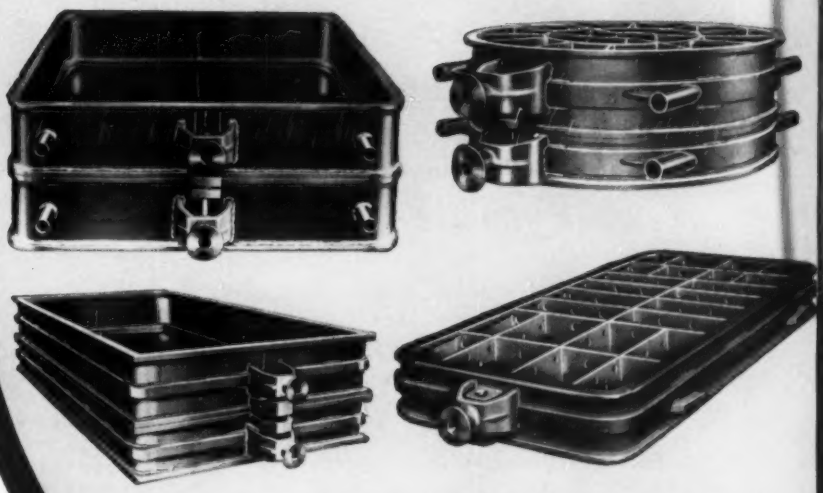

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No lost time in freeing stuck ingots. Keeps maintenance costs down. For complete information on "National" graphite stool inserts, write to National Carbon Division, Union Carbide and Carbon Corporation, Dept. AF.

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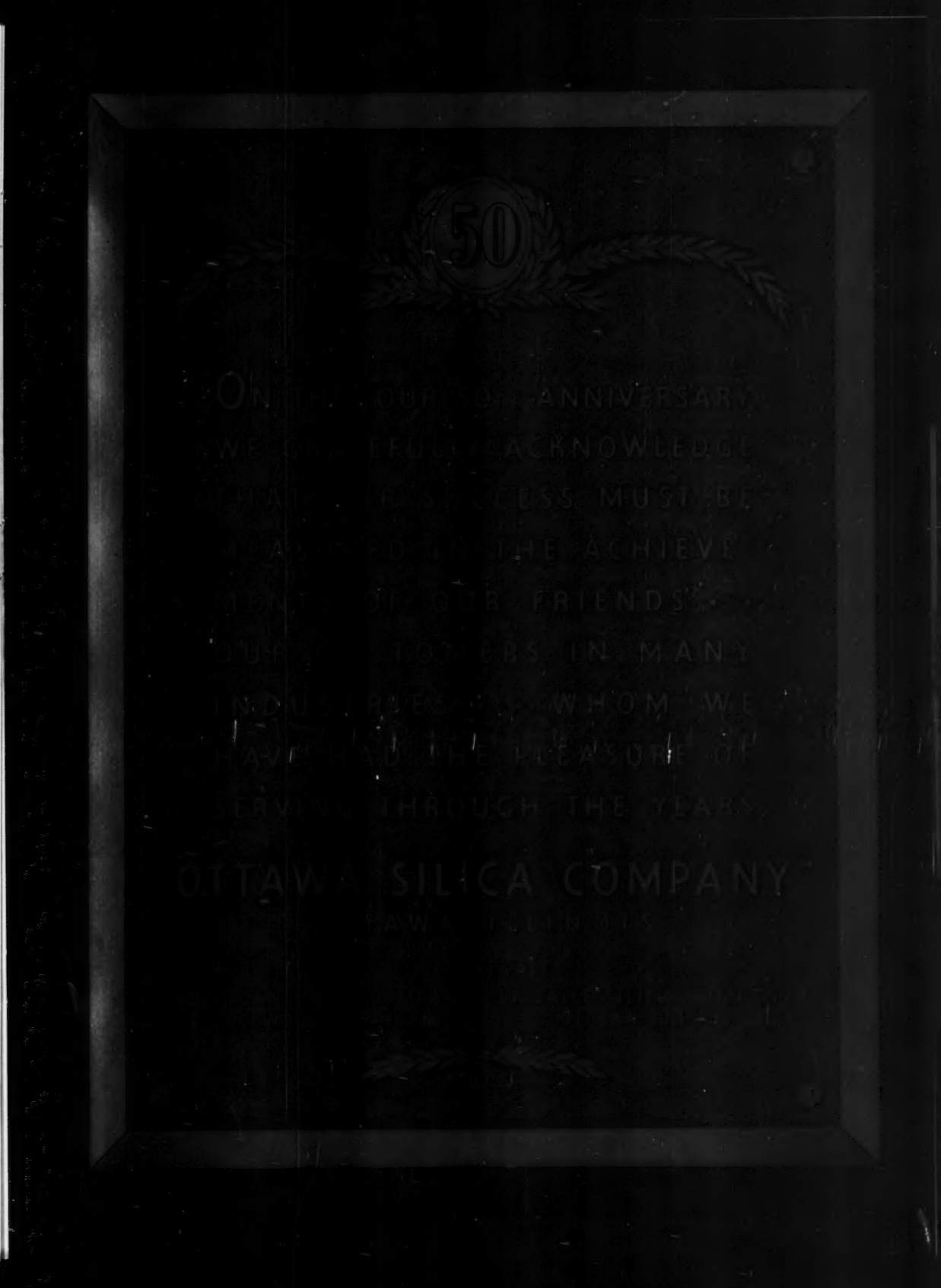
The biggest news since the invention of flashlights—the brand new leakproof "Eveready" No. 1050 flashlight battery—gives more than double the usable brilliant white light for critical uses than any other flashlight battery we have ever made. NO METAL CAN TO LEAK OR CORRODE.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Is your company ringing the bell

FOR EVERYONE'S FINANCIAL INDEPENDENCE?

We all can help keep our country economically strong by pulling strongly in the Treasury Department's Independence Drive, May 15-July 4. Obviously this is important to you, because what's good for the nation is good for you and your company.

The purpose of this drive is to increase everyone's financial independence through the regular purchase of United States Savings Bonds. Your "pull" is needed because the greatest share of Series E Bond sales are made through the Payroll Savings Plan—and the Plan (now used by 21,000 companies) thrives best in any company when it gets top management's personal sponsorship.

If your company doesn't have the Payroll Savings Plan, now is certainly the time to install it! It's good "employee relations" to provide this convenience.

If your company does have the Plan, now's the time to put extra push behind it! Employees who pile up money in Savings Bonds feel more secure . . . are actually better workers. Moreover, Bond sales build a backlog of future purchasing power—good "business insurance" for all of us in the years ahead.

The Independence Drive is being powerfully promoted throughout the nation by radio, television, publication advertising, posters, car cards, and special ceremonies. The public is *extra* Bond-concious at this time. Make sure your company adequately informs your employees that the convenience of "automatic" Bond buying is available through your Payroll Savings Plan.

This is your country—so it's *your Drive.* Help to put it over. All the material and assistance you need are available from your State Director, Savings Bonds Division, U. S. Treasury Department. Go into action now!

The Treasury Department acknowledges with appreciation the publication of this message by

American Foundryman

BOOST BONDS FOR INDEPENDENCE • PROMOTE PAYROLL SAVINGS •

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SAND-MEX®

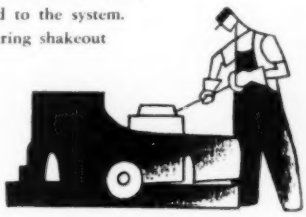
THE IDEAL FOUNDRY SAND CONDITIONER

Sand-Mex is an economical, specially prepared graphite product which, when mixed with foundry sand, increases the flowability and refractoriness of the sand. Sand-Mex is super-refractory, non-gaseous and chemically inert. By coating each grain, Sand-Mex increases stability of the sand and reduces friction between the sand grains. It insulates the sand from chemical or physical contact with the metal, and less expansion and contraction of the sand occurs when the metal is poured into the mold — this means sharper pattern impressions, resulting in castings truer to patterns.

Application: Sand-Mex is easily and economically applied to molding sands at the rate of 40 pounds per ton of sand. Sand-Mex remains permanently in the sand and further additions are made only when new or untreated sand is added to the system. Sand-Mex should be thoroughly mixed, preferably mulled with the sand, in order to obtain best results.

Pouring: Sand-Mex makes molding sand easier to work, gives it greater stability by reducing expansion and contraction in pouring. It prevents chemical reaction between iron oxide and sand, thus helping to eliminate rat-tails, scabs and other defects . . . Sand treated with Sand-Mex, flows more easily and does not hang or bridge in the hoppers — permits all the system sand to be used for molding.

Shakeout: Sand-Mex increases the flowability and collapsibility of sand. This reduces shakeout time to a minimum because the sand has less retained strength, is not so strongly fused, and is more easily broken down. Also, more sand is returned to the system. Damage to casting during shakeout is minimized.



Finishing: Sand-Mex results in cleaner castings with better color and finish. Sand-Mex prevents sand from clinging to the casting — makes cleaning easier. Less finishing time, better castings . . . only two more reasons why Sand-Mex is ideal for foundry use.

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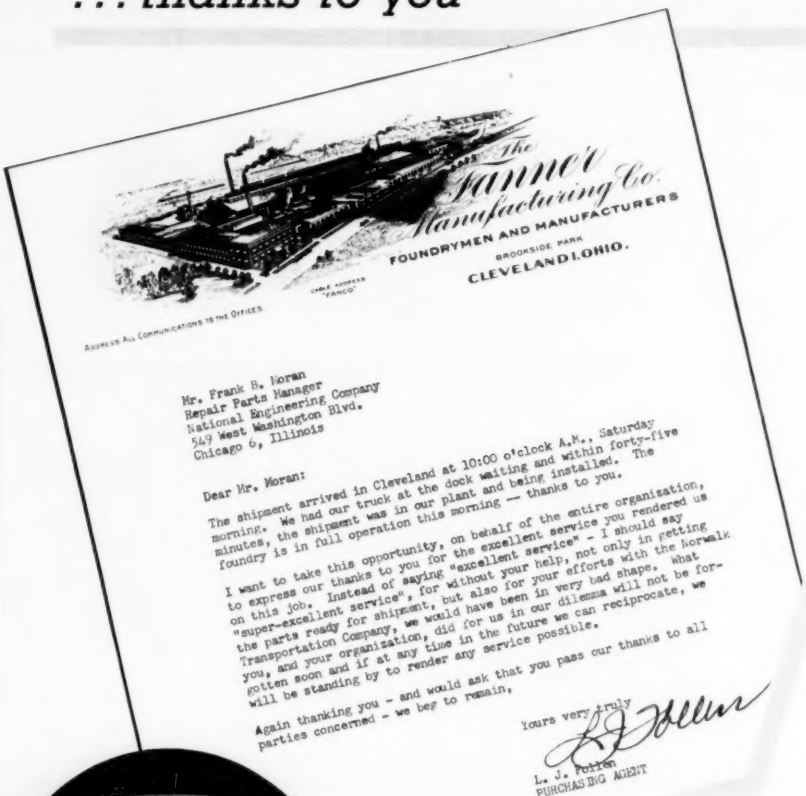
"The foundry is in full operation this morning . . . thanks to you"



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FOUNDRYMEN AND MANUFACTURERS
BROOKSIDE PARK
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ADDRESS ALL COMMUNICATIONS TO THE OFFICES

Mr. Frank B. Moran
Repair Parts Manager
National Engineering Company
549 West Washington Blvd.
Chicago 6, Illinois

Dear Mr. Moran:

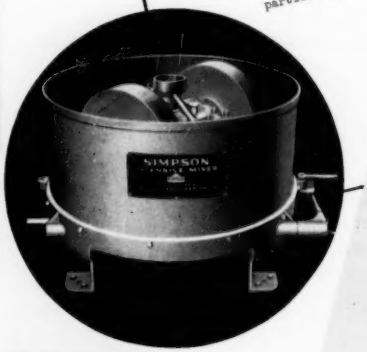
The shipment arrived in Cleveland at 10:00 o'clock A.M., Saturday morning. We had our truck at the dock waiting and within forty-five minutes, the shipment was in our plant and being installed. The foundry is in full operation this morning — thanks to you.

I want to take this opportunity, on behalf of the entire organization, to express our thanks to you for the excellent service you rendered us on this job. Instead of saying "excellent service" - I should say "super-excellent service", for without your help, not only in getting the parts ready for shipment, but also for your efforts with the Norwalk Transportation Company, we would have been in very bad shape. What you, and your organization, did for us in our dilemma will not be forgotten soon and if at any time in the future we can reciprocate, we will be standing by to render any service possible.

Again thanking you - and would ask that you pass our thanks to all parties concerned - we beg to remain,

Yours very truly

L. J. Follen
PURCHASING AGENT



Thanks, Mr. Follen . . . your letter helps to point out that National Engineering Company stands ready to furnish spare parts and service at a moment's notice. We realize the importance of uninterrupted operation, and will always do our best to help keep your foundry in full operation . . . by furnishing a Simpson Mixer part, or providing completely engineered plans for new or revised layouts.

Let a National Engineer work with you on your next production problem . . . and show you how to bring your Simpson Mixer up to date with the latest National developments. *For complete details, write for your copy of the new Modernization Bulletin 503.*

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Reprinted herewith from the January 1948 issue of *American Foundryman* is an editorial by R. G. McElwee, manager, iron foundry division, Vanadium Corp. of America, Detroit, who died June 21 (see page 57 this issue). Long active in A.F.S. committee work, he headed the Gray Iron Division and the Cupola Research Committee. His editorial speaks for all current, past, and future members of A.F.S. committees and divisions.

PARTICIPATING IN A.F.S. COMMITTEE WORK

DURING THESE DAYS of material difficulties, real or fancied, it becomes very important that every foundryman re-appraise his position with respect to quality and prepare himself and his organization to take advantage of the fundamental data offered in the technical literature.

The various sub-committees of the A.F.S. Gray Iron Division have been and are very active in the dissemination of data useful to all makers of gray iron. The ANALYSIS OF CASTING DEFECTS book is the most recent release; the CUPOLA HANDBOOK and others came earlier. The committees responsible for these publications do not consider their task finished, but rather are organizing anew to fill the gaps disclosed by their original activities.

One of the best ways for any organization to acquire the new knowledge, and make it applicable to its own needs, is to have a representative on one of the active committees, or to invite such a committee to co-operate with the technical staff of the operating company.

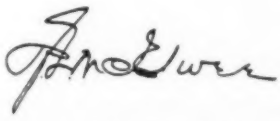
The most important effect of the application of newly acquired basic knowledge is the whetting of the appetite for studies of other fields, equally important, but unexplored. To those who work and contribute to committee assignments the vista of future research and improvement of practice is an ever expanding challenge. Our meager knowledge of fundamentals of gray iron metallurgy is at once apparent to any serious worker in this field.

The A.F.S. Gray Iron Division has need for many serious workers, for the committees already organized as well as for those areas not at present assigned to committee personnel. Unfortunately, many of those best qualified technically and with available facilities find it necessary or convenient to answer with a negative reply based on being "too busy."

It should be apparent to those who are fearful of time involved that the repetition of names in committees, year after year, is in itself an indication of the personal gain and pleasure these faithful ones find in co-operating with others and contributing to the general knowledge of a branch of the castings industry.

To those who intend to do it "some day" let me add the doctor's admonition which is especially appropriate—"never chew your pills." To those who do not know where to start, let me say that the important thing is to get started, even in a small way, and new avenues will open surprisingly fast.

To management, the training and the facilities for consultation with colleagues should be sufficient incentive to request and require of your staff activities for the common good which will repay you out of all proportion to your individual outlay for such participation.



R. G. MCELWEE, *Chairman*
A.F.S. Gray Iron Division

CHAPTER OFFICERS MEET IN CHICAGO

WITH EVERY CHAPTER REPRESENTED, and a large contingent of national directors present, the Seventh Annual American Foundrymen's Society Chapter Officers Conference was held June 26 and 27 at the Stevens Hotel, Chicago. Presiding at the meeting, against a background of flags of the United States, Canada, and Mexico, was President-Elect Walton L. Woody, National Malleable & Steel Castings Co., Cleveland. Lead-off speaker and conductor of the free-for-all closing session—The Shakeout—was National President E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md.

Operated as a school for chapter chairmen and program chairmen, the Conference consisted of 18 sessions on chapter administration, program building, A.F.S. technical activities, functions of the National Office, AMERICAN FOUNDRYMAN, membership work, educational work, and other national and local activities of the Society and its chapters. Participating along with chapter chairmen and program chairmen were the following: Vice-President-Elect Walter L. Seelbach, Superior Foundry, Inc., Cleveland; and National Directors T. H. Benners, T. H. Benners & Co., Birmingham, Ala.; Robert Gregg, Reliance Regulator Div., American Meter Co., Alhambra, Calif.; T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa.; L. C. Farquahr, American Steel Foundries, East St. Louis, Ill.; F. G. Sefing, International Nickel Co., New York; James Thomson, Continental Foundry & Machine Co., East Chicago, Ind., Martin J. O'Brien, Jr., Symington-Gould Corp., Depew, N. Y.; Frank W. Shipley, Caterpillar Tractor Co., Peoria, Ill.; and E. C. Troy, foundry engineer, Palmyra, N. J.

Hair mussed, tie askew and hand in pocket, Quinn R. Prichard of Midwest Institute, Chicago, demonstrates how NOT to conduct a chapter meeting in a session, "Booby Traps for the Chairman," program opener.

Looking at photograph of foundry class at Hackley Manual Training School, Muskegon, Mich., whose foundry courses were revived by the A.F.S. Western Michigan Chapter are, left to right: Central Michigan Chairman Jack F. Secor; George K. Dreher, executive director, Foundry Educational Foundation, Cleveland; and Chairman Howard Wilder of Saginaw Valley.

Following welcoming remarks by Conference Chairman Woody, National President Horlebein set the pace for the two-day meeting by discussing the Society's background. He outlined A.F.S. activities since the

organization's formation as a technical society in 1896. Activities and projects mentioned included the Annual A.F.S. Convention and the Foundry Show which the Society sponsors on behalf of the foundry industry, educational work, research projects, and the role played in formation of foundry trade associations.

Secretary-Treasurer Wm. W. Maloney explained the functions of the National Office, and told how the chapters can help Headquarters serve them better. Displaying an organization chart, he explained the extent and limitations of authority of the various A.F.S. officers, committees, and staff members, and outlined the duties of the 25 members of the National Office.

"Booby Traps for the Chairman" was presented by Quinn R. Prichard, Midwest Institute, Chicago, in a 30 minute session during which he unsuccessfully negotiated 39 pitfalls of a leader of a meeting. He followed his instructive, humorous act with a talk and demonstration of the right way to conduct a meeting.

First session after lunch was a discussion of A.F.S. technical activities by Technical Director S. C. Massari. He outlined the organization of a typical division (A.F.S. has eight—gray iron, steel, malleable, brass and bronze, aluminum and magnesium, sand, pattern, and education) and told how the technical committees operate, discussed the nine current research projects going on under Society sponsorship, and gave a preview of the safety and hygiene and the cupola research programs which will be intensified this fall.

Approve Permanent A.F.S. Home

Chairman Woody commented on the Building Project, first proposed at the A.F.S. Alumni Dinner during the 1950 Convention, and chapter leaders and national directors registered enthusiastic support for the plan to provide the Society with its own home.

Balance of the afternoon was devoted to chapter administration and chapter program building under the direction of Secretary-Treasurer Maloney. He led a two-hour discussion on such topics as chapter continuity and growth, chapter board of directors, committees, finances, and an advisory board of past-presidents. The Program Committee, developing outstanding programs, guest speaker courtesies, regional conferences, special events, and national officer visits were among items covered under the heading of chapter program building. Importance of the Speaker Evaluation Report and use of the A.F.S. Speaker List were brought out and the Preferred Speaker List—based on nominations—was prepared.

Top A.F.S. officials presiding at the Chapter Officers' Conference were, left to right: Vice-President-Elect Walter L. Seelbach; President E. W. Horlebein; President-Elect Walton L. Woody, Conference chairman; and National Secretary-Treasurer Wm. W. Maloney.

The evening program kept conference participants in the dark as they went through 45 minutes of simulated blindness while E. F. Chittenden and George Zang of Unitcast Corp., Toledo, Ohio, put on their *"Let's Pretend"* safety training program. Blindfolded, in a darkened room, the group lit cigarettes, distinguished types of cloth, tried to read Braille, and learned about other phases of life as it would be if they lost their eyesight.

The second day's meeting started with a discussion of AMERICAN FOUNDRYMAN. Editor Herbert F. Scobie listed seven goals for "The Foundrymen's *Own* Magazine"—reliability, understandability, convenience, variety, uniformity, eye appeal, and leadership—and briefly told how they were being approached. Taking his listeners behind the scenes, he told how the June issue was planned, and showed how it approached conformity with the magazine's aims.

Advertising Manager Terry Koeller briefed the growth of AMERICAN FOUNDRYMAN from a small news magazine to a technical publication and explained the role of advertising in making possible the publication of more good technical information.

Membership records, National Office procedures, selection and operation of chapter membership committees, and other phases of membership work were covered in a session led by Secretary-Treasurer Maloney, with Membership Supervisor LaVerne Lahn and chapter officers participating.

Pre-luncheon session was devoted to chapter educational work. Technical Assistant Jos. E. Foster reported on the 1950 A.F.S. Apprentice Contest and urged all chapters to participate next year by holding chapter contests to select representatives for the national judging. Mr. Maloney stated that a national essay contest was under consideration.

National Director F. G. Sefing, long a leader in A.F.S. educational activities and former chairman of the Educational Division, explained the importance of interesting young men in the foundry industry, and

Central New York Chairman David Dudgeon, Jr., left; Texas Chairman W. H. Lyne, III, center; and Cincinnati District Vice-Chairman A. W. Schneble, Jr., picking up hints for their chapter photographers.

Long-distance travelers to the Conference were, left to right: A.F.S. National Director Robert Gregg of Alhambra, Calif.; N. S. Covacevich, Mexico City program director; Henry W. Howell, Southern California vice-chairman; Fernando Gonzalez Vargas, Mexico City chairman; and Philip C. Rodger and John R. Russo, vice-chairman and chairman of Northern California.

stated that foundries should make themselves known in their communities by arranging plant visitations for students and their families. Eastern Canada Chapter Chairman Turney Shute told of the continued success of his chapter's educational work which includes an annual foundry papers contest. Several of the papers are published each year in AMERICAN FOUNDRYMAN.

Other chairmen reported on educational courses and their activities with the Society's nine student chapters. National Director Robert Gregg outlined the Southern California Chapter's essay contest (see page 65). As a result of the interest created by the contest, held for the first time this year, chapter directors have allotted $500 for the 1951 contest, and the number of junior colleges and trade schools participating in the visitations and essay competition will be increased.

Luncheon speaker was George K. Dreher, executive director, Foundry Educational Foundation, who said that results of the Foundation's activities are measured in terms of graduates placed in the foundry industry (180 this year) and the influencing of some 5000 students per year to include castings use and design, in their thinking.

Speaking briefly before Mr. Dreher was FEF Board Chairman Stowell C. Wasson, National Malleable & Steel Castings Co., Chicago, who stressed the importance of foundry industry aid and advice to schools.

La Verne Lahn of the A.F.S. National Office explains the complexities of A.F.S. membership processing to A.F.S. National Director Martin J. O'Brien, Jr., center, and Central Ohio Chapter Chairman D. E. Krause.

Convention and Exhibits Manager A. A. Hilbron reported on the success of the 1950 A.F.S. Convention and Foundry Show, to open the final series of sessions after lunch. Housing applications for the 1951 Convention—to be held in Buffalo, April 23-26—will be mailed to all Society members about the first of the year, he said. The Buffalo Convention and Tourist Bureau will handle housing and all applications received by the bureau prior to February 15, 1951, will be considered as of that date.

Other topics discussed as the Conference drew to a close were national nominations and elections, A.F.S. awards, and Society finances. Fiscal operations of the Society approach $1 million in a two year period such as must be considered in planning the income and expenditures of A.F.S., Secretary-Treasurer Maloney explained. Conference attendants studied where the A.F.S. dollar comes from and where it goes.

Conference Chairman Woody called on National President Horlebein to conduct the final session, The Shakeout, during which matters not previously discussed and questions left unanswered earlier were brought up.

Programs of A.F.S. Chapter Officers Conferences are designed to help chapter chairmen and program chairmen plan and execute activities for their groups and most attendants hold these offices. Program chairmen are generally also vice-chairmen of their respective chapters; their additional duties are indicated in the following list of this year's delegates:

BIRMINGHAM—Chairman Morris L. Hawkins, Stockham Valves & Fittings, Inc., Birmingham, Ala.

BRITISH COLUMBIA—Chairman Lovick P. Young, A-1 Steel & Iron Foundry, Ltd., Vancouver, B. C., and Program Chairman W. M. Armstrong, University of British Columbia, Vancouver, B. C. (Also V. C.)

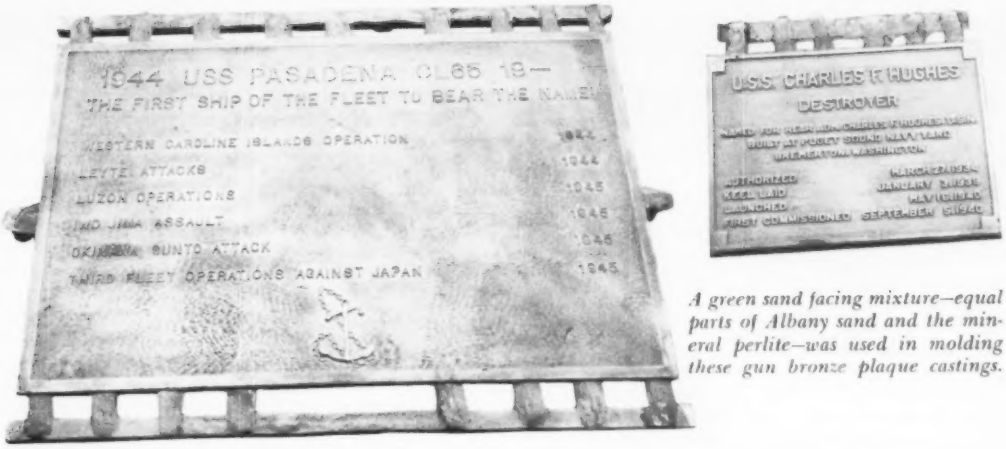
CANTON DISTRICT—Chairman T. W. Harvey, Pittsburgh Valve & Fittings Div., Pitcairn Co., Barberton, Ohio, and Program Chairman Chester B. Williams, Massillon Steel Castings Co., Massillon, Ohio (Also V. C.)

CENTRAL ILLINOIS—Program Chairman Robert E. Dickison, Asst. to Mgr., Brass Foundry Co., Peoria, Ill. (Also V. C.)

CENTRAL INDIANA—Chairman Allen J. Reid, General Refractories Co., Indianapolis, Ind. Program Chairman Robert Spurgin, III, Swayne Robinson & Co., Richmond, Ind. (Also V. C.)

CENTRAL MICHIGAN—Chairman Jack F. Secor, Hill & Griffith Co., Niles, Mich., and Secretary Thomas T. Lloyd, Albion Malleable Iron Co., Albion, Mich.

(Continued on Page 90)



A green sand facing mixture—equal parts of Albany sand and the mineral perlite—was used in molding these gun bronze plaque castings.

MINERAL PERLITE—FOUNDRY USES

E. D. Boyle
Master Molder
Puget Sound Naval Shipyard
Bremerton, Wash.

RECENT INVESTIGATIONS at the Puget Sound Naval Shipyard in the use of sand additives for improving insulating properties of molding sands and cores indicate that the mineral perlite can be used to reduce speed of solidification of molten metal and to eliminate expansion type casting defects. Indications are that it is superior to the usual materials added to sand to counteract expansion.

Perlite, found in million-ton beds in Arizona as a gray or greenish volcanic rock, contains about 2 to 5 per cent water of crystallization. On quick heating to the softening temperature—1600 to 2600 F depending on the source of the material—perlite puffs up to form low density granules with good insulating properties. In contact with molten metal in the mold, the perlite globules form a plastic siliceous coating over the sand grains, thereby preventing buckling of the mold face.

The author's first use of perlite was in conjunction with development of methods for insulating risers to maintain fluidity. All experiments previously reported from the Shipyard in "Promoting Riser Fluidity" (AMERICAN FOUNDRYMAN, Feb., 1949, p. 45) in which diatomaceous earth was used were repeated, and results with non-ferrous and iron castings were excellent. On non-ferrous castings the results were better than with diatomaceous earth as an insulator.

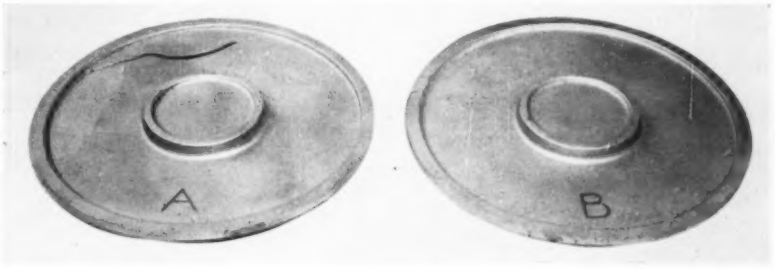
A simple and very effective use of perlite is as a cover for risers. A layer of about 3 in. of the powdered material is sufficient. With non-ferrous metals the perlite can be reclaimed and used over several times.

Where the ultimate in shrinkage control is desired a collar of perlite, in the form of a core, can be used. Mixture for the cores is:

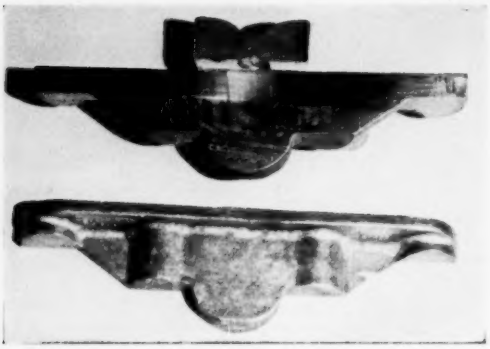
	Weight	Volume
Grade "0" perlite	2 lb	2 gal
Bentonite	9 oz	½ pt
Powdered asbestos	10 oz	½ pt
Water	12 oz	

After mixing and shaping, using the usual techniques for cores, the collars are baked in a core oven at 400 F for 3 hr. Shrinkage of the metal leaves the collars free and readily removable, and if sufficient taper is used on the cores for non-ferrous castings they can be used four times satisfactorily.

An example of the use of perlite as a cushioning agent in non-ferrous sand is shown in the photographs of the bronze plaques. The larger bronze plaque, 26½x39x¼ in. thick, is a gun bronze casting poured at 2400 F. The metal was melted in a lift coil induc-



Cast steel gear covers (25-in. diameter, 80-lb weight) were poured in molds with (A) standard steel sand facing, and (B) steel sand facing containing mineral perlite to eliminate buckle and scab defects on the flat surface. (All photographs in this article were made by the U. S. Navy Department.)



Manganese bronze lifting pad casting sectioned to show (lower portion) casting contour and (upper portion) the riser and insulating perlite knock-off core in place. The riser was covered with 2 in. of powdered perlite to maintain metal fluidity and promote feeding.

tion furnace. A green sand facing was used, consisting of equal parts by volume of Albany sand and perlite (1 gal Albany sand–grade 0; 1 gal mineral perlite–grade 0; 5 oz bentonite; 1 pint water). The sand laboratory results on a 160-gram sample were: moisture 10.4 per cent; compression 8.6 psi; permeability 10.0; toughness 33.5.

The facing mixture was riddled over the pattern surface to a depth of approximately 2 in., and the heap sand placed over it with a very snug ramming. The pattern was withdrawn and the mold closed with no additional finish. The molding time for this plaque was 3 hr. The old method which called for special facings, printing back, and skin drying the mold, required 6 to 8 hr, and the results were not as satisfactory as in green sand.

Many foundrymen believe it is impossible to obtain good results with sand of such high moisture and toughness, and with such a low permeability. The writer's opinion is that the perlite, being globular and hollow in structure, allows for easy escape of gases.

Old insulating sleeve material of perlite and diatomaceous earth, ground up and with a small amount of exothermic material added, makes an excellent covering for cast steel risers. The exothermic material gives off heat, the insulation localizing it where needed.

In the illustration of the cast steel covers, (A) was poured in silica molding sand without the addition of perlite as a cushioning agent; (B) was poured in a mold of the following sand mixture: 1,000 lb new silica sand; 40 lb bentonite; 3 lb dextrine gums; 2½ lb wood resin; 14 lb grade "0" perlite. The test was repeated on several molds and in every case buckles and rattails appeared on casting (A). Casting (B), poured in sand molds with perlite additions, was free of defects.

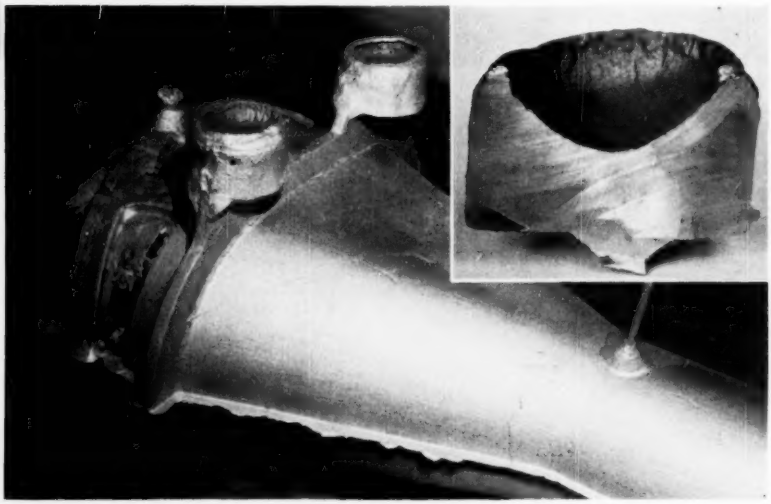
In pouring a composition "M" naval valve bronze seachest casting (cleaned weight, 730 lb) the risers were covered to a depth of 4 in. with the powdered perlite. The photograph of the seachest casting shows the pulling down of the riser metal adjacent to the sand area, and the cuplike shrinkage in the riser. The sectioned riser from the seachest (inset) shows even shrinkage in the riser and the absence of piping.

Manganese bronze (Navy Specification 46B29) risers are reduced to minimum size with the use of powdered perlite on the risers. On larger castings the use of a knock-off core, in addition to the powder, will reduce the chipping and cleaning costs.

Solid manganese bronze bushings, 3 in. in diameter and 18½ in. long, were poured with bottom gating and the riser end covered with perlite. The sectioned riser showed the pipe confined to the riser.

Manganese bronze lifting pads were cast with perlite knock-off cores and 2 in. of powder on top of the risers. The insulating core keeps metal liquid enough to feed to the heavy boss sections.

For cast iron risers it was found that a mixture of equal parts of perlite powder and diatomaceous earth provided the best riser protection.



Feeding was promoted in this composition (M) naval bronze seachest casting by covering the riser with 4 in. of powdered perlite. The sectioned riser (inset) shows uniform shrinkage without piping. The risers are 6½ in. in diameter and 4 in. high above the riser neck.

PLAN NEW REGIONAL CONFERENCE

NEWEST REGIONAL FOUNDRY CONFERENCE in the A.F.S. network of foundry area group meetings is the Texas Regional Foundry Conference now scheduled for October 5 and 6. Originally set for two weeks later, the dates were changed to minimize conflicts, according to James R. Hewitt, Houston, who is conference chairman. The conference, sponsored by the Texas Chapter and the Texas A. & M. Student Chapter, will be held in San Antonio's Plaza Hotel.

First conference of the fall takes place at the Royal Connaught Hotel, Hamilton, Ont., where the Eastern Canada and Ontario Chapters, will hold their All-Canadian Foundry Conference September 28-30. Murray N. Tallman, A. H. Tallman Bronze Co., Ltd., Hamilton, who has just assumed Ontario Chapter chairmanship, is in charge of the conference with Chapter Vice-Chairman R. H. Williams, Canadian Westinghouse Co. Ltd., assisting. Scheduled are a three-day sand lecture course, technical papers and discussions, and plant visitations.

The Third Annual Metals Casting Conference, sponsored by the Michiana and Central Indiana Chapters, and by Purdue University, will be held on the Purdue campus at West Lafayette, Ind., on November 2 and 3. L. L. Andrus, American Wheelabrator & Equipment Corp., Mishawaka, Ind., is chairman; Prof. C. T. Marek, Purdue, is vice-chairman. The program will open with a discussion of recent engineering developments in the foundry industry. A talk on casting design will emphasize the relationship of design to production methods.

New Color, Sound Research Film

Foundrymen attending the conference will be among the first to see the latest A.F.S. research film on fluid flow. This motion picture, not yet released, reports on the past year's work on gating under the direction of the Society's Aluminum and Magnesium Research Committee. Technical talks will cover gating and risering, and foundry sand.

Foundry Educational Foundation activities will be reviewed; Purdue is one of the 12 schools participating in the FEF program. A new feature of the conference will be an educational display of foundry products, accompanied by photographs taken in the industry, to demonstrate unique methods in the production of castings and the solutions to design problems which have resulted in more profitable production methods.

Dates of this year's Michigan Regional Foundry Conference are November 10 and 11. Professors C. C. Sigerfoos and Austen J. Smith of Michigan State College at East Lansing, where the conference will again be held, are chairman and co-chairman, respectively. Sponsoring the conference, along with the college, are the Detroit, Central Michigan, Saginaw Valley, and Western Michigan Chapters and Michigan State College Student Chapter. Other regionals scheduled are the Wisconsin, the Birmingham, and the Ohio, all to be held in 1951.

Linking the modern city of San Antonio—where the Texas Regional Foundry Conference will be held—with its glamorous past is Mission San Jose de Aguayo.

Select 1951 Hoyt Annual Lecturer

JAMES C. ZEDER, director of engineering and research for Chrysler Corp., Detroit, has accepted the invitation of the Annual Lecture Committee to deliver next year's Hoyt Lecture at the A.F.S. Convention in Buffalo, April 23-26. One of the technical highlights of A.F.S. Foundry Congresses, the Hoyt Lecture is presented each year by an outstanding figure in the foundry or engineering field. Mr. Zeder has been connected with Chrysler Corp. ever since it was organized in 1925 and has been associated with the large casting consuming automotive industry since his graduation from the University of Michigan in 1922.

J. C. Zeder

Proposal that Mr. Zeder prepare the 1951 Hoyt Lecture was made at a meeting of the Annual Lecture Committee at A.F.S. Headquarters, June 8. Committee members are: Gosta Vennerholm, Ford Motor Co., Dearborn, Mich., *chairman;* H. Bornstein, Deere & Co., Moline, Ill.; Carl F. Joseph, Central Foundry Div., General Motors Corp., Saginaw, Mich.; Fred J. Walls, International Nickel Co., Detroit; and Robert E. Ward, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.

New Office for Non-Ferrous Founders

SINCE MAY 1 the Non-Ferrous Founders' Society has occupied new quarters. New office address is Room 507-508, 192 North Clark St., Chicago 1, Ill.

PRESIDENT'S ANNUAL ADDRESS

Delivered During The Annual Business Meeting Of The Society At The 1950 A.F.S. Foundry Congress & Show

AN OLD QUAKER SAYING goes like this: "What I give away, I take with me."

No words of mine could better describe the intent, the opportunities and effect of Conventions and Exhibits staged by your Society on behalf of the entire castings industry. It is in the very spirit of A.F.S. that as you contribute to the knowledge of others, so will you add greatly to your own fund of information. The Society owes much to all who have, in the spirit of that old Quaker saying, made possible this year's splendid Convention technical program and one of the finest Exhibits ever seen.

Your Society today has a great many activities, over and above the staging of Conventions and Exhibits. It is a book publisher. Witness the 30 odd special publications of A.F.S., plus the annual bound volume of TRANSACTIONS. These publications are in constant demand throughout the world. The importance of this activity has resulted in our setting up a special committee on publications policy.

We are also in the business of publishing a magazine AMERICAN FOUNDRYMAN. Its recognition editorially and by advertisers is a matter of record, and your Directors have plans for its continued growth.

Eight Research Projects Under Way

A.F.S. today is carrying on eight fundamental research projects in several divisions of the castings field, including brass and bronze, gray iron, light metals, steel, malleable, heat transfer, sand, and cupola operation. Reports of these projects were presented at this year's Convention and in AMERICAN FOUNDRYMAN. Every effort is made to avoid duplicating the work of others, and extremely capable men are in charge of each project.

Our chapter organization is being constantly encouraged and improved. Today we have 40 regular chapters and nine student chapters, supported largely by substantial refunds from the dues of chapter members. The activities of these local groups can hardly be over-encouraged, since they bring to thousands the kind of information that can be offered only to hundreds at Conventions such as this.

We are actively engaged in educational work—encouraging young men for foundry careers. All of you are familiar with the slogan conceived by A.F.S. in 1943: "The Foundry is a *Good* Place to Work." This slogan has gone all over the foundry world, and permission to reprint or use has been freely granted. Our work in the field of education is primarily at the secondary school level, for the most part through chapter educational committees. At the college level, the fine work of the Foundry Educational Foundation has been strongly supported and widely recognized.

Cites Work of Technical Committees

The technical affairs of the Society are carried on through some 100 committees—all but a few within our eight major technical divisions. I constantly marvel at the faithful service of the men who thus serve A.F.S. For example, one committee has had 100 per cent attendance at every meeting held for the past three years. Committee service is open to any member willing to attend meetings and contribute to the work of the Society.

In terms of membership and finances, your Society is sound. During the past 12 months there has been some loss in membership, but less than estimated, due largely to prevalent foundry conditions. This loss will be more than regained with 10 per cent more castings business. Your Board has devoted much thought and effort to building substantially larger financial reserves, reducing operating expenses, and developing additional legitimate sources of income. It must be remembered that the Society is a non-profit corporation, and that it has but one objective in its expenditures: to advance the art and science of metal casting.

A word about two Convention matters. We have been constantly striving for *quality* in Convention papers . . . every paper and report presented at the 1950 Convention was approved by a Program and Papers Committee before being accepted. The National Office succeeded in preprinting fully 60 papers—a new record—for distribution in advance of the Convention either in pamphlet form or in AMERICAN FOUNDRYMAN. These preprints were offered gratis to members on request.

Two exchange papers—one British, one French—were offered for presentation at the 1950 A.F.S. Convention. The British paper, reviewing English achieve-

ments in light metal alloys, was presented by Frank Hudson, Mond Nickel Co., Ltd., London, England. The French paper was received too late for preprinting, but will appear in the 1950 TRANSACTIONS. Presented by title, it is *"Formation of Technical Management Groups for the French Foundries."* Author is Jean Maurice Laine, head of the French Technical College and vice-president of the French Foundry Technical Association.

This paper (abstracted on page 39) describes the establishment in France of a foundry school at the college level. It is government sponsored and financed. A certain number of students is selected for entry each year, and all graduates are definitely placed in foundries. It is stated that 70 per cent enter into executive or supervisory jobs. Just in passing, may I add that England also has a National Foundry College.

Board Formulates Long-Range Policies

This brief report on the Society was augmented in the June issue of AMERICAN FOUNDRYMAN (page 25) by a *Report to the Membership*. Meanwhile, your Board is actively engaged in a long-needed task: correlating previous Board actions and decisions in order to formulate, for the guidance of all, more definite Board and Society policies. It is a big task, but under way.

And now, as I refer once more to our Board, it becomes my sad duty also to report the loss of three of our National Directors since the 1949 Convention in St. Louis. Last June, Director Harry G. Lamker of Teterboro, N. J., was taken; in July, Director Joseph E. Kolb of Peoria, Ill.; and in January this year, Director A. M. Fulton of St. Paul, Minn. The Society can ill afford the loss of men like these, all of whom were long identified with A.F.S. and the castings industry.

During the past two years I have had considerable contact with chapter problems and operations. Last year, while our then-President W. B. Wallis was setting a new endurance record of visiting every chapter, I received many reports of chapter visits by Board members. This year I have visited over a dozen local groups myself, and the Board as a whole has again contacted practically every Chapter of A.F.S. This remarkable evidence of interest by your elected Directors should not go unnoticed, for every one of them takes his responsibilities seriously. For example, our California Director, Robert Gregg, made two 1800 mile trips up and down the Pacific Coast on chapter visits.

Such extensive travel activity may, perhaps explain why, among the officials of A.F.S., weariness and lonely wives are rapidly becoming occupational hazards.

A.F.S. Is "Big Business"

In reading the annual address of a President of some 20 years ago, I noted with astonishment his glow of pride over having experienced during his term of office what he called "the old spirit of close fellowship and camaraderie."

In an organization of nearly 10,000 members, we may yearn for the good old days, but I fear that they, like the days of no income tax, are gone forever. How much gay camaraderie can you generate at the spout of a continuous tap cupola or in a mechanized cleaning room? How much close fellowship can you derive from such a five-ring circus as the 1950 Convention?

Your Society today is not the Society of 1922, the "good old days" when the membership stood at 2300. Today A.F.S. is big business, with an income this year expected to exceed half a million dollars. Such growth has called for self-analysis . . . new perspectives . . . careful examination of our operating pattern . . . lest we dissipate the industrial confidence that has made such growth possible. At the same time, we must never forget nor minimize the importance of the personal element.

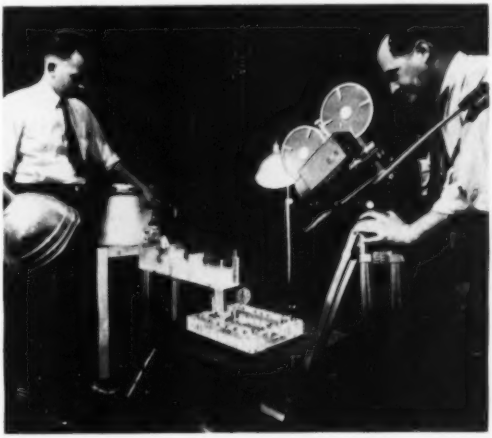
Measures to Insure Financial Stability

During the past two years A.F.S. members have noted the effects of a definite policy toward widening the gap between income and expense of certain Society activities. Some of these effects you have approved; others, not. I refer to such items as Convention registration fees, membership dues, advertising solicitation, exhibit space rental fees, and the pricing of some special publications.

The thinking back of these measures is that A.F.S. must be operated more as a business and less as a charitable institution. Every action taken by the Board of Directors is considered in the light of accumulating funds that may be made available for essential activities. We have no so-called "fringe" activities. The consequences of our not having adopted such policies earlier are now evident to many of us.

For example, the Board recently approved re-establishment of a strong Safety and Hygiene project to

"Fluid Flow in Transparent Molds," 16-mm silent film produced at Battelle Memorial Institute as part of the A.F.S. Aluminum & Magnesium Division Research Project, was shown this year at Chapter, Regional and National meetings of the Society with nationally-known foundrymen acting as commentators. A second film dealing with metal flow, this time in color and equipped with a sound track, has been completed as part of the Research Project and will be available for scheduled showings on or about October 1. These films represent one of the many ways in which A.F.S. Research constantly furthers the foundry art.



develop codes of recommended practice on such subjects as dust control and air pollution. This work will require $35,000 a year for a minimum 10-year program, and these funds cannot be obtained from current operating revenues of the Society. Therefore, we must look to those firms that realize the need and stand to benefit most from the program for its financial support.

Traditionally—or perhaps I should say notoriously—A.F.S. has failed to blow its own horn sufficiently to acquaint foundry management with its activities and accomplishments. The truth of the matter is that, while management's *personal* interests undoubtedly have changed in the past quarter century, *managing* interests of management have not. No foundry operator can afford to ignore the benefits to be derived by his company from active support of A.F.S.

Men like myself 20 years ago were acquiring a personal knowledge of how to make castings through A.F.S. committee service, at A.F.S. Conventions and Exhibits, in A.F.S. chapter meetings, from A.F.S. publications, and through personal contacts with other members. To managers who have gone "up the ladder" and today find other interests, let me say:

Your men are like *you* were 20 years ago. They are your future executives, your anchors of security—and they are willing to learn as you did; *if you encourage them to do so.* You can spend your firms' money—and little enough it is—in no wiser way than to *insist* that they be members and participate to the fullest in what this Society has to offer for their personal advancement.

Training of "New Blood" For Foundries

During the past four years, foundrymen have voluntarily contributed nearly $600,000 to train and induce young engineers to enter the foundry industry. That is splendid. It marks a new era in progressive foundry thinking. But keep in mind your own wheat when you help the neighbor harvest his. Don't overlook the undeveloped talents and capabilities of your own employees who, like the young engineers, must be encouraged to advance.

Right here I should like once more to refer to the annual address of a former A.F.S. President. Here are President Washburn's remarks in 1939 on management's responsibility in A.F.S.:

"The tremendous developments in the recent past and in the present in engineering, in metallurgy and in new materials present a more serious challenge to our industry than it has ever faced, and the successful answer to this challenge cannot be found in the efforts of a few. It calls for the very best that can be brought forward by every firm and individual interested in the casting of metals. Membership is not the responsibility of your officers, not of a committee—it is the responsibility of every member."

I have a strong belief that the foundry industry has not yet assumed its full responsibilities in another direction also . . . the development of a strong and continuous program of castings promotion. This industry has now grown up, and most of our old jealousies and suspicions have been broken down. Through the National Castings Council, for instance, we have developed for the first time a Foundry Advisory Committee to the Munitions Board. Through the Foundry Educational Foundation we have learned how we can advance our mutual interests. Let us now direct our efforts into even broader channels.

When will we realize that the engineers who design metal structures must be impressed, thoroughly and continuously, with the electrifying fact that the shortest distance between raw material and finished product is a CASTING? When will we as an industry learn to spend our dollars in stressing those inherent advantages that have made a casting the most useful and utilitarian of all metal structures? When will we employ our brains and our means to teach others that a casting is both a material and a process . . . and why it is so tremendously important to the engineer?

Recently your Society proposed that A.F.S. and ASME initiate an annual exchange paper arrangement, with papers from ASME on what the engineer seeks from cast metal structures; from A.F.S. on what he can expect from castings. We need this kind of cooperative effort, and we have hopes that our proposal to ASME may be approved . . . but this is only one step forward.

United Effort to Boost Castings

It will require all-out foundry effort to bring the utility of all cast products to the attention of engineers. It is too big a job for any one firm or organization, or for any one segment of the industry. It is a job for all, if we are to avoid duplication of effort.

Nothing will so effectively and permanently refute the charge that the foundry industry is "backward" as will such a joint endeavor. But someone must start the ball rolling. I propose, therefore, to those of you who represent the various foundry organizations, the formation of a Joint Castings Promotion Committee to explore the need and possibilities, to develop a long-term plan and budget, and to report findings and recommendations to the 1951 Convention.

Impressions of a President

As President, I confess to having experienced, many times during the past year, the humility of one whose success depends largely on the work of others. I suppose every new President has certain strong ideas on what he feels is important to accomplish. During the year, these ideas are tempered, beaten, and shaped by discussions with many men, and in the end, the good metal survives and is put to use, the inferior or off-true goes back for recast.

Certain impressions and deep satisfactions remain, however. First, the knowledge of having tried to leave something better than before. Second, the constant warmth of friendliness expressed by the chapters, the Directors, the committee members, and the National Office staff. I cannot express too strongly my respect for the thousands of men who give their time, energy, and brains to A.F.S. so willingly. To the companies who permit their men to give such effort, the Society owes a debt of gratitude.

Lastly, let me leave with you these thoughts: No President of A.F.S. can serve out his term of office without acquiring new respect for all who serve the Society so faithfully. No President can step down without having been broadened in the process and lifted up by the support he has received.

FORMATION OF TECHNICAL MANAGEMENT GROUPS FOR THE FRENCH FOUNDRY INDUSTRY

FRANCE'S ADVANCED FOUNDRY SCHOOL was started in 1923 with the first lectures being conducted in 1924 by Eugene V. Ronceray, founder of the institution. Licensed in June, 1925, the school has graduated to date 604 students including 64 foreigners.

Enrollment is governed by the demand of the foundry industry and the number of students per year averages 20 to 30. Smallest number was nine in 1936. Applicants are 20 to 30 years old, most of them engineers promoted by the schools and approved by the Ministry of Education.

Because of the short school term—October to July—students are requested to go through a minimum of 12 months practical training before starting their advanced educational work. Industrial training is directed by the management of the school and reports describing activities in the principal section of the foundry have to be submitted.

The school program includes all basic sciences, such as metallurgy, physics, chemistry, and the principal departments of a typical foundry. For graduation, students must pass 20 oral examinations.

Statistics show that not one of the graduates of the Advanced Foundry School has had any difficulty in obtaining a position in the industry. Students have been accepted by 150 French foundries. Of the graduates, 80 per cent have gone to independent foundries; 15 per cent have returned to the companies which sent them to the school for study; and 5 per cent are devoting their careers to research. Other figures show that 38 per cent have become foundry managers, 32 per cent have become production managers, 23 per cent have become directors or foundry owners, 5 per cent entered laboratories, and 2 per cent found other positions in the foundry industry. In 1948, 60 per cent of France's 2400 foundries employed less than 20, 30 per cent from 20 to 100, and less than 10 per cent employed 100 to 500 workmen.

Jean Maurice Laine, *director of France's Advanced Foundry School, and vice-president of the Association Technique de Fonderie, prepared this year's exchange paper from the Association to the American Foundrymen's Society. To be published in full in the 1950* TRANSACTIONS OF A.F.S., *a resumé of the paper is printed here as abstracted from the French by Henry Zimnawoda, National Engineering Co., Chicago. Mr. Laine has an extensive background of knowledge of the French foundry industry and the organization of its personnel. He holds diplomas designating him an engineer of arts and crafts and a graduate engineer of the Advance Foundry School, and he is a civil engineer. His affiliation with the School has been as engineer and as professor. Before assuming his present post with the Association Technique de Fonderie he was technical secretary, then general secretary. He has been research director at the Technical Center of the French Foundry Industries, information and personnel clearing house.*

Casting 14 Feet Of Chain In A Mold

Chromium-molybdenum steel chain 14 feet long is cast in a single mold in the foundry of Ph. Bonvillain & E. Ronceray, Choisy Le Roi, France. Robert Ronceray, son of A.F.S. Gold Medalist Eugene V. Ronceray —founder of France's Advanced Foundry School, a frequent attendant at A.F.S. Conventions, brought the picture of the unusual chain casting to this year's A.F.S Foundry Congress and Show in Cleveland.

A.F.S. TECHNICAL CORRELATION, PUBLICATIONS COMMITTEES LAY PLANS AT MID-YEAR MEETINGS

RECENT ACTIVITIES of the more than 100 national technical committees of the American Foundrymen's Society were reviewed at a meeting of the Technical Correlation Committee, in Chicago, June 19. Appointed chairman by National President E. W. Horlebein was R. G. McElwee, Vanadium Corp. of America, Detroit, who presided over the meeting just two days before his death (page 57). Made up of the chairmen and vice-chairmen of the Society's eight divisions and the chairmen of the general interest committees, the Technical Correlation Committee members are a cross-section of top technical talent of the foundry industry and meet annually to appraise past year's activities and plan new work.

Annual reports of the various committees and divisions were presented by representatives of those groups or by Technical Director S. C. Massari. Major items of discussion included new and revised publications, plans for the technical sessions of the 1951 A.F.S. Annual Convention to be held in Buffalo, April 23-26, Society-sponsored research projects, dissolution of committees whose work has been completed, and formation of other groups to initiate new projects. Participating in the meeting along with President Horlebein, Mr. McElwee, Mr. Massari, and committee representatives were Secretary-Treasurer Wm. W. Maloney, and Technical Assistant Jos. E. Foster.

On recommendation of the Publications Committee, the Technical Correlation Committee voted to revise the CAST METALS HANDBOOK under the editorship of a full time staff member. Format and text content of the revised HANDBOOK are to be established by a new committee. The book will be prepared as a manual for engineers who design castings.

FOUNDRY TERMINOLOGY, a glossary of foundry terms initiated by the Aluminum and Magnesium division and now in prepublication form (page 40), was discussed and arrangements made for representatives of each division to review the material prior to release as a separate publication later this year.

Other publication activities reported included: a design manual in preparation by the Aluminum and Magnesium Design and Stress Analysis Committee; RECOMMENDED PRACTICES, being rewritten by members of the Brass and Bronze Division and to include 22 chapters of which ten will be entirely new; revision of the sand testing handbook by the Sand Division to bring it up to date and to add new sections; completion of editing of PRECISION INVESTMENT CASTING which is expected sometime in September; preparation of the REFRACTORIES MANUAL scheduled to be edited by the end of the year.

Progress of the Alloy Recommendation Committee of the Aluminum and Magnesium Division in collecting in tabular form the chemical, physical, mechanical, and foundry property data on aluminum casting alloys was indicated. Comparable work in the magnesium casting alloy field will be developed later. Work on a book on microstructure of cast iron was reported to be well toward completion.

Plans for the 1951 A.F.S. Convention have already been formulated for the light metals sessions, and will include presentation of papers on centrifugal casting, test bar gating, aluminum and magnesium foundry practices, light alloy casting design, and a third progress report on fluid flow. Malleable Division plans for Convention papers include a number of practical operating interest and a paper developed out of Controlled Annealing Committee activities.

The Plant and Plant Equipment Committee has scheduled tentatively two sessions for next year's Convention. Proposed subjects are non-destructive testing equipment and practices, equipment and methods for casting straightening and dimensional inspection, heat treating equipment, and a molding equipment movie.

According to the Timestudy and Methods Committee, Convention papers will continue to build up the symposium collection under development, and will include a detailed report on the fatigue allowance survey initiated this year.

A.F.S.-sponsored research projects are being enthusiastically received by the foundry industry, members of the Technical Correlation Committee agreed, in reviewing achievements of the various research committees to date. A general program for continuation of the work of the Centrifugal Casting Committee sponsored jointly by the Canadian Bureau of Mines and A.F.S. has been formulated according to that com-

Publications Committee members study May issue of AMERICAN FOUNDRYMAN *at Society Headquarters with Secretary-Treasurer Wm. W. Maloney, and Technical Director S. C. Massari. Seated, left to right, are: W. D. McMillan, International Harvester Co., and Chairman H. M. St. John, Crane Co., both of Chicago; A.F.S. President E. W. Horlebein; and Past-President F. J. Walls, International Nickel Co., Detroit. Standing, left to right, are: C. H. Lorig, Battelle Memorial Institute, Columbus, Ohio; H. J. Rowe, Aluminum Co. of America, Mr. Massari, and Mr. Maloney.*

mittee of the Aluminum and Magnesium Division. The Division's Research Committee reported that substantial contributions to gating made on the fluid flow project sponsored with Battelle Memorial Institute have resulted in a second movie in color and sound. The first, a black and white silent film, has been shown more than 75 times during the past year.

These films have stimulated many ferrous as well as non-ferrous foundrymen to comment on the value of A.F.S. research results which they say represent a significant direct return from Society membership, according to the annual report of Walter E. Sicha, Aluminum Co. of America, Cleveland, who is chairman of the Aluminum and Magnesium Division.

The Research Committee of the Brass and Bronze Division presented its second progress report on *"Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass"* at this year's Convention. This research carried on at the University of Michigan permits correlation between fracture and melt quality in three minutes.

Plan Cupola Handbook Revision

Gray Iron Division research going on at Massachusetts Institute of Technology covers gating and risering, it was stated, with the preliminary report contained in the bibliography, RISERING OF CASTINGS. The Cupola Research Committee is gathering data for a revision of the CUPOLA HANDBOOK and is in need of funds to continue its research work.

The Research Committee of the Malleable Division reported completion of its first project on best microstructure for selective hardening, and is now planning work on the effect of melting atmospheres.

The oldest A.F.S.-sponsored research project—steel sands at elevated temperatures—carried on under the Sand Division at Cornell University is currently concerned with effect of grain size, stress-strain at elevated temperatures, and correlation between maximum strain and expansion, it was reported. Progress on the Steel Division's study of effect of mold materials on hot tears being carried on at Armour Research Institute, Chicago, like that in other research projects was the subject of a Convention paper.

Cope And Drag Club Elects Officers

MEETING during the A.F.S. Convention recently held in Cleveland, the Cope and Drag Club elected officers to head the organization during its third year. Chairman for 1950-51 is Victor M. Rowell, Trabon Co., South Bend, Ind. New vice-chairman is Eugene Conreaux, Illinois Mills Inc., Granite City, Ill. Members of the club who organized two years ago are: Roy W. Bennett, Hydro-Blast Corp., Chicago; O. J. Myers, Foundry Sales Div., Archer-Daniels-Midland Co., Minneapolis; Jos. S. Schumacher, Hill & Griffith Co., Cincinnati; Robert L. Doelman, Miller & Co., Chicago; George P. Antonic; Leo F. Dennie, Black Products Co., Chicago; Bradley H. Booth, Carpenter Bros., Milwaukee; Clyde A. Sanders, American Colloid Co., Chicago; Frank S. Brewster, Harry W. Dietert Co., Detroit; and Eugene W. Smith, Western Materials Co., Chicago. Admitted to membership at this year's annual meeting was Herbert F. Scobie, editor, AMERICAN FOUNDRYMAN.

Thomas S. Hammond Dies

T. S. Hammond

NOTED SOLDIER, industrialist, civic leader, and Past President of the American Foundrymen's Society, Brigadier General Thomas Stevens Hammond, 67, chairman of the Board of Whiting Corp., Harvey, Ill., died June 15 at his home in Chicago. Paralleling a distinguished career as an industrialist with an outstanding military record in two World Wars, General Hammond was at various times president of many civic and industrial organizations, including the American Foundrymen's Society, National Foundry Association, Foundry Equipment Manufacturers' Association, National Metal Trades Association, Electric Overhead Crane Institute, the Armour Research Foundation, and many others.

Serving A.F.S. two three-year terms as a Director, Vice President (1932) and President (1933), General Hammond was elected an Honorary Life Member in 1933.

Born October 29, 1883, at Crown Point, N.Y., he attended the University of Michigan, where he was a member of the famous "point-a-minute" football team. The following year, 1907, he joined the Whiting Foundry Equipment Co., now the Whiting Corp., as purchasing agent, rising to the position of president and general manager and, in 1945, Board chairman.

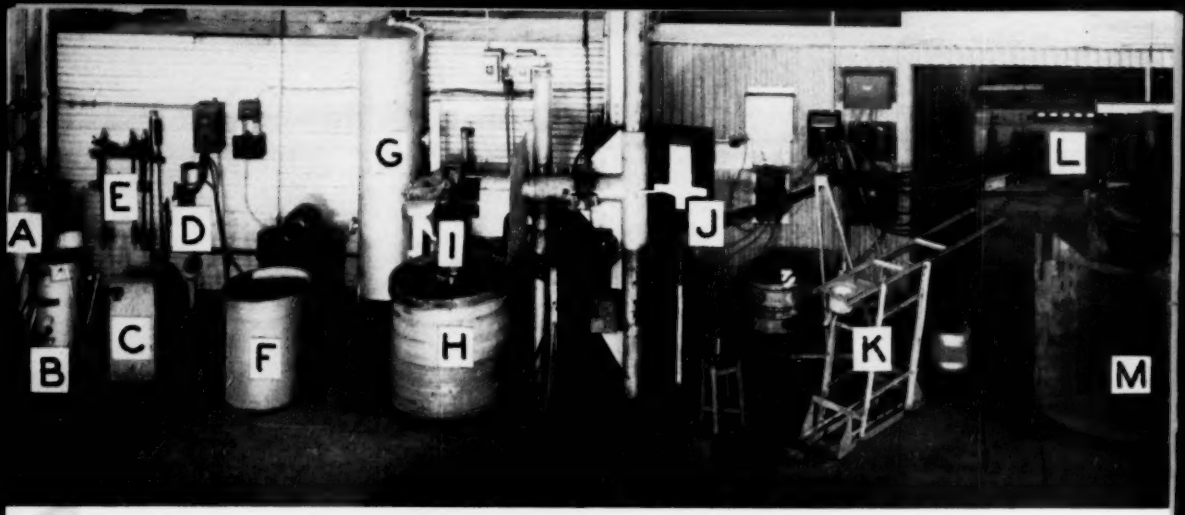
Enlisting as a private in Battery C, 1st Illinois Field Artillery, in June, 1915, he was commissioned a first lieutenant a year later and saw eight campaigns in France during World War I, winning the rank of Officer in the French Legion of Honor.

Discharged as a lieutenant colonel in 1919, Hammond was commissioned colonel of the 33rd Division's 124th Field Artillery Regiment in 1921, and brigadier general in command of the 65th and later the 66th Infantry Brigades. He was retired as a major general in 1940 to return at war's outbreak as chief of the Chicago Ordnance District. For his work in this capacity from 1942 to 1946, General Hammond was decorated by the Government.

General Hammond is survived by his widow, Barbara Whiting Hammond, daughter of pioneer foundry equipment manufacturer and A.F.S. Past Vice-President John H. Whiting, donor of the John H. Whiting Gold Medal, and by two sons, Stevens H. and Thomas L. Hammond, executives of Whiting Corp.

鐵鋼學輓近の進步

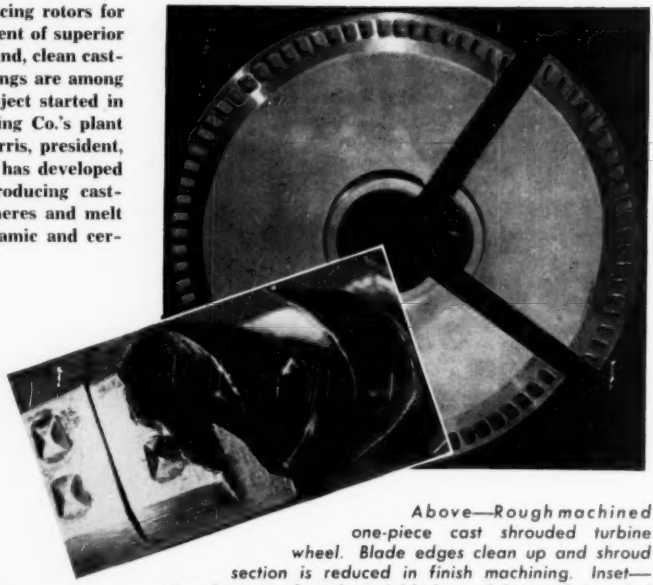
TRANSLATED, the title of this newest acquisition to the A.F.S. Library is *"A Consideration of the Recent Progress of Iron and Steel in Japan,"* by Prof. Keizo Iwase of Tohoku University, Japan. Written in Japanese, this 316-page volume is bound in blue cloth.



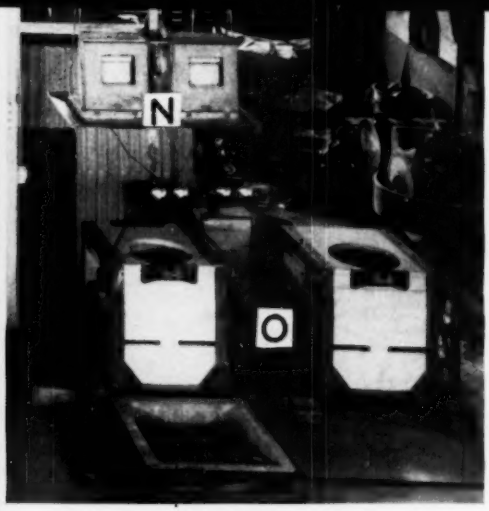
MODERN FOUNDRY METHODS . . .

NAVAL RESEARCH PROJECT DEVELOPS UNUSUAL FOUNDRY TECHNIQUES

Elimination of costly methods of producing rotors for steam and gas turbine use, and development of superior casting processes for the production of sound, clean castings of uniform grain size to replace forgings are among major objectives of a Navy research project started in June, 1947, at Alloy Engineering & Casting Co.'s plant in Champaign, Ill. Directed by H. H. Harris, president, General Alloys Co., Boston, the research has developed three radically different methods for producing castings; new developments in mold atmospheres and melt degassing; ceramic-faced sand cores; ceramic and cer-



Above—Rough machined one-piece cast shrouded turbine wheel. Blade edges clean up and shroud section is reduced in finish machining. Inset—Rough sectional cut through blades on fabricated shrouded Bureau of Ships steam turbine wheel. Blades are milled from solid piece with shroud riveted to blade projections. Wheel is costly, shrouds sometimes fail. Left—Cast 79-blade shrouded turbine wheel with blades formed by ceramic segments. Produced by new centripetal process, casting was made in ceramic-faced mold. Metal enters mold through sprue in center, passes through wheel to ceramic cup in bottom of mold. Radial gates carry metal to ring gate where, traveling at same speed as mold, metal flows upward through vertical ingates. Entering outer rim of wheel, metal progresses smoothly and continuously toward center instead of being thrown from center to rim of wheel as occurs in centrifugal casting. Spoke or angled gates from the center downgate can be used but metal cleanliness is sacrificed. Ingates coming from below or above can bend as casting shrinks, avoiding strain and deformation.



Advanced casting facilities at Alloy Engineering & Casting Co., Champaign, Ill. Gas bottles for mold atmosphere control are at A. B is electric convection desiccator for dehydrating ceramics. Heater C preheats radiation pyrometer target tubes for pyrometer D. Immersion pyrometers are at E. F is 28 in. centrifugal casting machine with rotating guard. G designates vacuum pump and tank. 40 in. centrifugal casting machine H includes riser-heating induction coil; trajectory spout pouring assembly I is hydraulically operated for vertical precision travel. Position of spout is indicated on chart of cross section of mold at J. Rocking cradle K is for secondary pouring basin. Induction heating unit L permits controlled solidification of risers. M is centrifugal casting machine with 72 in. turntable. Pouring controller N hangs from crane hook and in use supports a ladle. It mounts a dynamometer scale, two pyrometer recorders, a recording movie camera, and a cooling fan. Induction heated holding ladles O will be equipped for bottom pouring for metal flow control.

. . . MODERN FOUNDRY METHODS

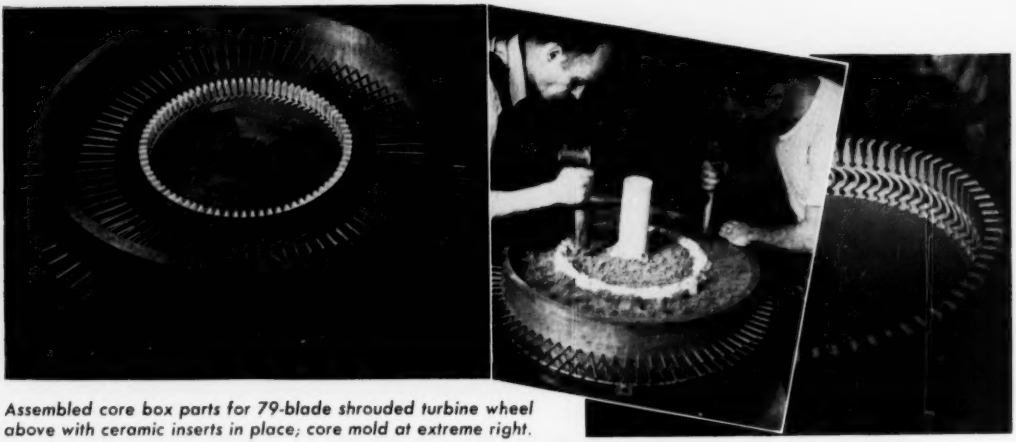
Watching plastic bonded ceramic-faced cores going through the "aeccotron dielector," dielectric heating machine developed on the research project are (left to right): Commander R. H. Lambert, Bureau of Ships; H. H. Harris, General Alloys Co., Boston; N. E. Promisel, Bureau of Aeronautics; and Robert Martin, physicist-operator.

amic-graphite molds; continuous temperature and solidification control in the mold through induction heating and brine cooling; and a dielectric heater with variable voltage output automatically adjusted to varying loss factors. Two of the casting processes and some of their related operations are described in these five pages.

Usual method of producing shrouded steam turbine wheels is to insert machined blades into forged rotors where they are held by a specially designed keyed root. Where very high speeds are involved, the rotor and integral blades are milled from a single forged disc. Shrouding is subsequently attached to blade extensions which are peened over (see facing page).

In the newly developed centripetal or counter flow centrifugal process, blades and shroud are cast simultaneously. Feeding is from the rim of the casting and the metal solidifies from the center out. This puts the cooler metal with the finer structure in the center of the wheel where the greatest stress develops in a high speed rotor. It also permits the periphery to solidify last and shrink upon the already solidified metal, placing the center in compression and the rim in tension. This should permit cast rotors to compete with forged rotors on a weight, speed, and safety basis.

Core box parts for casting 79-blade shrouded steam turbine wheel. Precision cast blades, formed by ceramic segments F are located by 158 radial pins which go between outer ring C and middle ring D, holding blade cores between D and inner ring G. H is aluminum facing which mounts on print on B to form face of wheel. Mold board B supports and holds entire assembly. A is for gate core with ceramic distributor cup in center. K and L are ring and disc core boxes, respectively. Vertical ingates are shown at J. Assembled box, core being rammed, and completed complex core appear on the following page.



Assembled core box parts for 79-blade shrouded turbine wheel above with ceramic inserts in place; core mold at extreme right.

MODERN FOUNDRY METHODS . . .

Early studies of gating, metal flow, shrinkage, and other foundry problems were made with usual sand molds and cores, using a ring core to form the blades (right). With technique developed, wheels were then produced in ceramic-faced molds with ceramic cores. On the 16 in. shrouded wheel illustrated in this article, metal section of the 79 buckets ranges from 1/32 in. to 5/16 in. Alloys cast include 38 Ni-18 Cr and others which are not subject to grain size reduction by heat treatment and cannot be truly annealed, hence the advantage of the controlled-grain-size as-cast wheel over the forged and machined wheel.

Grain size control with resultant improvement and uniformity in mechanical properties is illustrated below in the cross section of a 320 lb centrifugally

Above—Ring core and core box used in preliminary studies of shrouded turbine wheel production. Left—Section of 320 lb centrifugally cast aircraft turbine rotor illustrates fine grain structure due to process control developed in alloy incapable of grain refinement through heat treatment. Below—Cope section of graphite mold used in trajectory spout centrifugal casting of aircraft turbine rotors.

cast wheel of N-155 alloy. Success of the method depends upon accurately controlled heat input through metal flowing into the mold, and upon controlled heat transfer from the mold. Significant factor is the controlled orifice trajectory spout developed during the research project.

Molds (right) used in the process are graphite or graphite-ceramic. Process starts with the mold which can be produced from a graphite-ceramic mixture formed on a potter's wheel, a sand and ceramic mixture molded in the usual foundry way or by advanced methods still "classified" or by machining graphite slabs. Wall thicknesses in the graphite or graphite-ceramic molds range between one-half to two inches and the metal inside the mold cavity is readily susceptible to cooling through brine-carrying copper tubing or heating by induction. Assembled mold consists of cope and drag sections

with concentric ceramic and transite sleeves which pass through the cope at the center. Casting is poured through trajectory spout lowered into sleeve which subsequently is filled with metal to act as a riser.

With the mold in the centrifugal casting machine and induction heating coil in place around the riser sleeve, the trajectory pouring spout (right) is inserted. The trajectory spout is a ceramic tube with a cup-shaped bottom containing an orifice of ¼ to ⅜ in. diameter. At the top of the spout is a pouring basin. Metal is discharged from the orifice at an angle of 15 degrees above horizontal. Trajectory is studied by making motion pictures through one-inch square mesh screen of the stream under various heads of liquid metal.

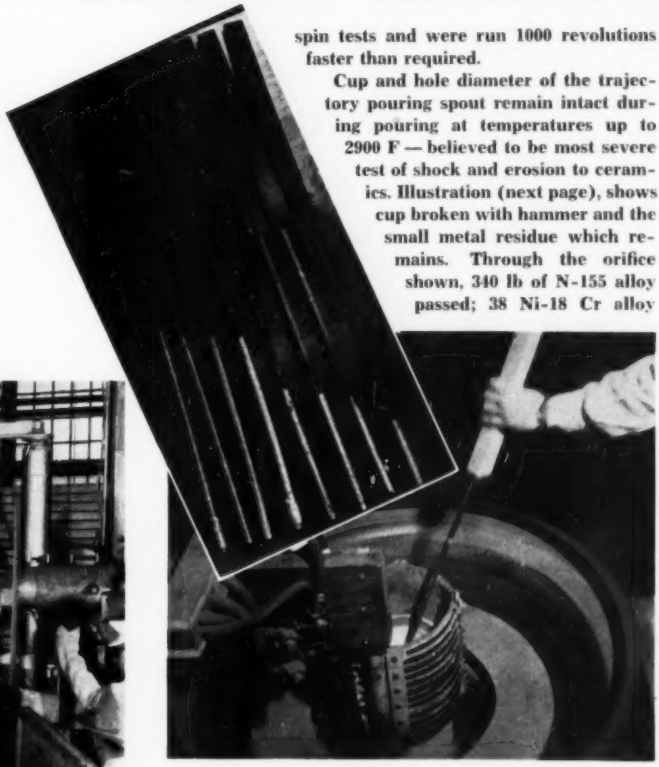
As pouring starts the mold is spinning and the spout is at its lowest level. Molten metal is laid against the outer surface of the mold cavity which fills at a predetermined rate. Timed by a metronome, the spout is raised by a hydraulic jack as the metal level rises. Position of the orifice throughout the pouring is shown by an indicator which traverses a chart of the cross section of the wheel being poured.

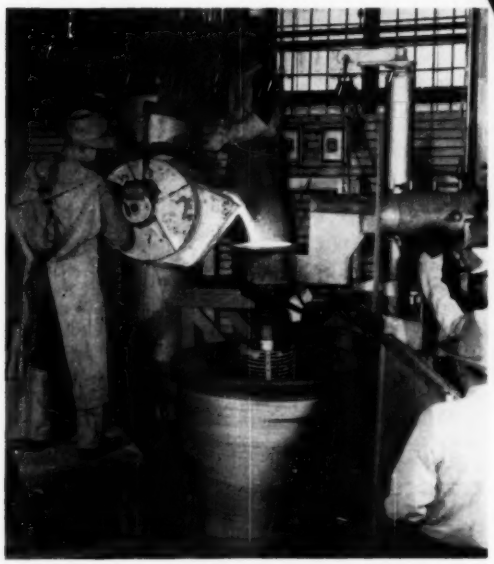
The trajectory spout is withdrawn when the metal level is up into the riser and additional molten metal is added directly to the head. Solidification of the head is controlled by controlled input of induction heat, which is now turned on, and checked by a series of probes dipped at intervals into the riser.

. . . MODERN FOUNDRY METHODS

Controlled solidification of head assures soundness in casting which comes out of mold (see next page) free of surface defects ready for machining. The process can be used for casting solid wheels or for wheels with cast-in blades. In the latter, the blades are produced separately and placed in the mold as inserts which become integral parts of the wheel when the plate and hub are cast. Such wheels with hollow blades, cast by the centripetal process described earlier — and statically using the same gating system — passed their spin tests and were run 1000 revolutions faster than required.

Cup and hole diameter of the trajectory pouring spout remain intact during pouring at temperatures up to 2900 F — believed to be most severe test of shock and erosion to ceramics. Illustration (next page), shows cup broken with hammer and the small metal residue which remains. Through the orifice shown, 340 lb of N-155 alloy passed; 38 Ni-18 Cr alloy





Left—Metal flows into pouring basin of trajectory spout which is moved vertically as metal level rises in spinning graphite mold. Above—After mold is filled trajectory spout is removed, head is filled, and solidification controlled by induction heating. Probes help keep head open and are an effective guide to control of solidification.

was successfully poured through the same orifice.

A third process developed by the company and employed on this Navy research project provides for centripetal casting of large numbers of small parts in stacked core molds. Gating, pouring, temperature and solidification control give castings of closely similar grain size and mechanical properties with minimum dimensional variation. The multicasting process, as H. H. Harris, project director, calls it, will appear later this year as a Modern Foundry Methods feature in AMERICAN FOUNDRYMAN.

A "metal meter" designed and constructed to give a continuous record of metal temperature and weights during pouring was used throughout the project. This pouring control consists essentially of a dyanometer for indicating weight of metal, two temperature recorders, and a clock, all suspended between crane hook and ladle. A motion picture camera gives a continuous record of weight, time, and temperature of metal in the ladle and

MODERN FOUNDRY METHODS . . .

Above—Removing graphite mold and casting from tub of centrifugal casting machine. Tall ceramic cylinder keeps induction coil far enough above graphite mold to avoid stray currents. Below—Rough casting with ceramic and graphite mold sections removed has uniformly fine grain size.

in the riser of the centrifugal castings through which the mold cavity is filled.

Riser temperature is indicated by platinum-rhodium immersion thermocouples. Ladle temperature is measured by a total radiation pyrometer sighted on the hemispherical end of a ceramic target tube immersed in the molten metal. No target tubes were available with a life greater than about six minutes and it was necessary to develop tubes with a minimum life of an hour.

In approaching its objectives of producing sound, clean, accurate castings . . . free of solidification stresses . . . of uniform grain size to meet gas turbine and other high temperature requirements . . . this project has pointed the way to increased yield, improved cleanliness and substantial economies in foundry floor space, and broader application of castings for defense and commercial requirements. Full cognizance has been taken of the inherent values of the casting process and of castings —such as the tri-laminar structure consisting of a tough, fine-grained outer skin, a stiffer, coarser grained core, and an intermediate region.

In compression in most cast shapes, the outer skin resists fatigue, shock, and is a vibration dampener. Coupled with the cast structure, unimpeachable cleanliness of metal, pouring temperature control, control of pouring rate, and elimination of gas producing materials in molds, can combine to broaden the field of castings utilization to the advantage of the foundry industry and to old and new users of castings.

The research described here—carried out at the top executive level for the largest user of castings in most diversified form, the Navy—was undertaken in the belief that improvement in castings and castings processes is vital to National Defense.

INSTITUTE OF BRITISH FOUNDRYMEN HOLDS CONFERENCE, ELECTS OFFICERS

T. Makemson, Secretary

Institute of British Foundrymen

Manchester, England

THE INSTITUTE OF BRITISH FOUNDRYMEN held its 17th Annual Conference June 6-9 in Buxton in the mountainous Peak district in the center of England. Famed as a spa from Roman times, the town is within an hour's ride of some of England's most important industrial districts, making possible visits to foundries, always an important feature of IBF Conferences.

The International Committee of Foundry Technical Associations and other international committees held their annual meetings in Buxton June 5 and 6. Chairman of the International Committee was its vice-president, F. W. E. Spies of Holland, who presided in the absence of Committee President Mont Frant Pisek of Czechoslovakia. At this meeting it was announced that Mr. Spies would become president in 1951 and that Italy would nominate the vice-president.

Presidential Chain Passed On

The Conference proper commenced the morning of June 7 with the Annual General Meeting of IBF, when Noel P. Newman, Newman, Hender & Co. Ltd., handed over the Presidential Chain to John J. Sheehan, Coneygre Foundry Ltd., Tipton, and installed him as president. Colin Gresty, North Eastern Marine Engineering Co. Ltd., and Cyril J. Dadswell, English Steel Corp. Ltd., were installed as senior and junior vice-president, respectively.

Before retiring from the chair, Mr. Newman presented the following awards for 1950: the Oliver Stubbs Medal to John Arnott, G. & J. Weir Ltd., Glasgow; the E. J. Fox Medal to S. H. Russell, leader of the Gray Iron Productivity Team which recently visited America, in acknowledgment of the contributions he has made to the welfare of the industry over many years; and Meritorious Services Medals to T. R. Walker, English Steel Corp., and A. S. Wall, Stanton Ironworks Co.

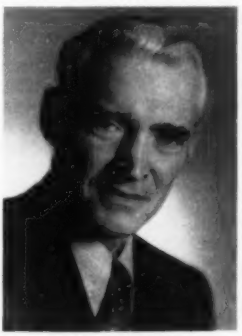
The British Foundry Medal was presented by Barrington Hooper on behalf of the *Foundry Trade Journal* to A. R. Martin, Northern Aluminum Co. Certificates of Honorary Membership were presented to John Cameron, Sr., past president, and Joshua Hogg.

President Sheehan devoted his presidential address to the human side of industry and entitled it "*A Way of Living.*" "*Gases and Steel*" was the subject of this year's Edward Williams Lecture delivered by Sir Andrew McCance of Colville's Ltd.

In the afternoon of June 7 two simultaneous technical sessions featured papers on cast iron and on aluminum. Papers presented were "*Some Properties and Applications of Spheroidal Graphite Cast Iron*" by A. B. Everest; "*The Properties of Cast Iron at Sub-Atmospheric Temperatures*" by C. N. J. Gilbert; and "*Experiences in the Application of Spectrographic Analyses in the Gray Iron Foundry*" by E. J. Ronnie and M. M. Hallett.

Non-ferrous papers were the A.F.S. Exchange Paper "*Non-Ferrous Investment Casting*" by Hiram Brown, Solar Aircraft Co., Des Moines, Iowa; "*Sand Cast Test Bars for Copper-Base Alloys*" by O. R. J. Lee and B. W. Peck; and "*Some Experiments in Sand Casting of Conductivity Copper*" by W. H. Glaisher.

On the morning of June 8 two sub-committees of the Institute presented reports on the repair and reclamation of gray iron castings and of non-ferrous castings. At a simultaneous session J. E. Worthington presented a paper on "*The Fluidity of Steel*" and V. Kondic presented "*The Effect of Liquid Metal Properties on the Casting Fluidity of Alloys.*" A highly technical research was described in "*Deformation Characteristics of Five Gray Cast Irons at 400 C and 500 C*" by C. R. Tottle.



John J. Sheehan

The afternoon of the same day H. G. Goyns presented a review of the South African foundry industry on behalf of the South African Branch of IBF. The Exchange Paper from the Belgian Foundry Association was "*The Rationalization of Sand Preparation*" by J. F. Goffart. Erik O. Lissell, Sweden, presented a valuable, interesting paper entitled "*Testing the Metal or Testing the Castings.*" French Association Exchange Paper by H. Laplanche at the same session was on "*Similarities Between Steels and Aluminum Bronze.*"

The Conference was attended by about 450 delegates and 150 ladies. Many overseas attendants were welcomed including Mrs. Wm. W. Maloney, wife of the Secretary-Treasurer of the American Foundrymen's Society, who flew over and who took part in most of the ladies' gatherings and in the social functions.

Plants toured by Conference delegates and visitors included Butterley Co., Ripley, Derby; Markham & Co. Ltd., Chesterfield; Staveley Iron & Chemical Co.; Sheepbridge Engineering Co.; the steel foundry of Hadfield's at Sheffield; and at Stoke-on-Trent, the non-ferrous foundries of Billington & Newton Ltd., and T. M. Birkett & Sons Ltd.

Among social gatherings held were a reception by the Mayor and Mayoress of Buxton, the Institute's Annual Dinner which was addressed by E. Player of Birmid Industries Ltd., a dinner dance and cabaret, and the President's Night entertainment.

A.F.S. Foundry Glossary . . .

DEFINES USEFUL FOUNDRY TERMS

IN PRE-PUBLICATION FORM, the first portion of an extensive foundry terms glossary to be published by the American Foundrymen's Society is presented in this issue of AMERICAN FOUNDRYMAN. Succeeding issues will contain the remainder of the glossary. Object of preliminary publication of this work is to secure comments and criticisms of readers to the end that the final booklet will be as complete and useful to the foundry industry as possible. Cooperation is solicited and suggestions for changes, additions, and deletions should be sent to Jos. E. Foster, Technical Assistant, American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill.

The present glossary is the outgrowth of a compilation of foundry terms started in 1948 by the Committee on Foundry Terminology of the A.F.S. Aluminum and Magnesium Division. Members of the committee are: A. W. Stolzenburg, Aluminum Co. of America, Detroit, chairman; Manley E. Brooks, Dow Chemical Co., Bay City, Mich.; and F. P. Strieter, Dow Chemical Co., Midland, Mich. This first glossary was distributed to a number of foundrymen for constructive criticism. Their comments and numerous existing glossaries and dictionaries of scientific and engineering terms were used in the preparation of the revision published herewith.

Final version of the glossary will combine comments of AMERICAN FOUNDRYMAN readers with those of a newly organized Committee on Foundry Terminology made up of members of each A.F.S. Division. Result will be a comprehensive explanation of terms used in the foundry industry.

A

abrasion—Wearing away of material at its surface due to cutting action of solids.

abrasives—Materials for grinding, polishing, blasting, etc., bonded to form wheels, bricks, and files, or applied to paper and cloth by means of glue. Natural abrasives include emery, corundum, garnet, sand, etc. Main manufactured abrasives are silicon carbide and aluminum oxide. Metallic shot and grit also are used as abrasives in cleaning castings.

acetylene—A colorless, tasteless gas composed of carbon and hydrogen used for welding and cutting operations in combination with oxygen. It is readily generated by action of water on calcium carbide.

acetylene generator—A multichamber apparatus containing calcium carbide and water with automatic controls for production of acetylene.

acid bottom and lining—In a melting furnace, the inner bottom and lining composed of materials that have an acid reaction in the melting process—either sand, siliceous rock or silica bricks.

acid brittleness — Brittleness induced in steel when pickling (cleaning) in dilute acid to remove scale, or during electroplating; commonly attributed to absorption of hydrogen.

acid refractories — Ceramic materials of high melting point consisting largely of silica.

acid steel—Steel melted in a furnace that has an acid bottom and lining, under a slag that is predominantly siliceous.

aerator—A machine for fluffing or decreasing density of, and cooling sand by admixture of air.

age hardening—An aging process that increases hardness and strength and ordinarily decreases ductility, usually following rapid cooling or cold working. See AGING.

agglomeration (flocculation) — Gathering together of small particles into larger particles in a liquid medium; usually used in connection with fineness test of clay or foundry sand.

aging — In a metal or alloy, a change in properties that generally occurs slowly at atmospheric temperature and more rapidly at higher temperatures. See AGE HARDENING, PRECIPITATION HARDENING, STRAIN AGING.

air belt—Chamber, surrounding the cupola at the tuyeres, to equalize volume and pressure of blast and deliver it to the tuyeres. Same as *air box; air chamber*.

air compressor—Machine to build up air pressure to operate pneumatic tools and other equipment.

air conditioning—Adjustment of temperature and relative humidity of air to provide optimum conditions for human comfort; term may also refer to control of moisture in cupola blast, removal of dust and smoke from foundry atmosphere, ventilation, etc.

air control equipment—Device for regulating volume, pressure or weight of air.

air-dried—Surface drying of cores in open air before baking in an oven; also applies to molds which air-dry when left open, thus causing crumbling or crushing when metal is poured; a core or mold dried in air without application of heat.

air-dried lumber — Lumber seasoned by drying out naturally, not in a kiln.

air-dried strength—Tenacity (compressive, shear, tensile or transverse) of a sand mixture after being air dried at room temperature.

air furnace—Reverberatory-type furnace in which metal is melted by the flame from fuel burning at one end of the hearth, passing over the bath toward the stack at the other end of the hearth; heat is also reflected from the roof and side walls.

air hammer — Chipping tool operated by compressed air.

air-hardening steel—An alloy steel that is hardened by cooling in air from a temperature higher than the transformation range. See SELF-HARDENING STEEL.

air hoist—Lifting device operated by compressed air.

air hole—A cavity in a casting caused by air or gas trapped in the metal during solidification.

alkali metals—Metals in group IA of the periodic system, including lithium, sodium, potassium, rubidium, cesium and francium.

alkaline earth metals—Metals in group IIA of the periodic system, including calcium, strontium, barium and radium.

allotropy—Occurrence of an element in two or more forms. For example, carbon occurs in nature as the hard crystalline diamond, soft flaky crystalline graphite, and amorphous coal.

alloy—A substance having metallic properties and composed of two or more chemical elements of which at least one is a metal.

alloying elements—Chemical elements constituting an alloy; in steels, usually limited to metallic elements added to modify the properties of the steel.

alpha iron—The form of iron that is stable below 910 C (1670 F) and characterized by a body-centered cubic crystal structure. See TRANSFORMATION TEMPERATURE.

alumel — A nickel-base alloy containing about 2.5 per cent Mn, 2 per cent Al and 1 per cent Si, used chiefly as a component of pyrometric thermocouples.

anchor — Appliance for holding cores in place in molds.

angle sleeker—Molder's tool for smoothing inside and outside corners of a mold.

anneal, malleable—A heat treatment which usually involves a slow cooling. As used with regard to malleable iron, it is a complete conversion, the hard brittle white iron being changed to tough ductile malleable iron by effecting malleabilization, or causing the carbon in the iron to precipitate in the free state as temper carbon.

annealing—A process involving heating and cooling, usually applied to induce softening. The term also applies to treatments intended to alter mechanical or physical properties, produce a definite microstructure, or remove gases. See GRAPHITIZING, MALLEABLIZING. Any pro-

cess of annealing will usually reduce stresses, but if the treatment is applied for the sole purpose of such relief, it should be designated as *stress relieving*.

annealing pots—Iron containers in which castings are packed for protection against the furnace atmosphere during annealing operation.

arbors — Metal shapes embedded in and used to support either green or dry sand cores.

arc welding — Welding accomplished by using an electric arc that may be formed between a metal or carbon electrode and the metal being welded; between two separate electrodes, as in *atomic hydrogen welding;* or between the two separate pieces being welded, as in *flash welding*.

arrestor, dust — Equipment for removing dust from air.

artificial aging—An aging treatment above room temperature. See PRECIPITATION HEAT TREATMENT and compare with NATURAL AGING.

artificial sand — Product resulting from crushing a rock to the size of sand grains, the fractures often passing through the component grains.

asbestos — Hydrated magnesium silicate used for insulation of risers, thus keeping metal molten for feeding purposes; production of plain cylindrical cores, packing pieces, etc.

assembling (assembly) line—Conveyor system where molds or cores are assembled.

austenite—Solid solution in which gamma iron is the solvent; characterized by a face-centered cubic crystal structure.

austenitizing—Process of forming austenite by heating a ferrous alloy into the transformation range (partial austenitizing) or above the transformation range (complete austenitizing).

autogenous welding — Method of uniting two pieces of metal by melting their edges together without solder or any added welding metal.

B

back draft—A reverse taper which prevents removal of a pattern from the mold.

backing board—A second bottom board on which molds are opened.

backing plate—See BACKING BOARD.

backing sand—Reconditioned sand used for ramming main part of mold.

baffle plate—A wall in a firebox or furnace to deflect or change direction of the flame.

baghouse—Large chamber for holding bags used in filtration of gases from a furnace to recover metal oxides and other solids suspended in the gases.

bail — Hoop or connection between the crane hook and ladle.

baked core — A dry-sand core which has been subjected to heat; green sand cores are used without baking.

baked permeability — The property of a molded mass of sand baked, at a temperature above 230 F (110 C) and then cooled to room temperature, to pass through it gases resulting during pouring of molten metal into a mold.

baked strength — The tenacity (compressive, shear, tensile or transverse) of a sand mixture when baked at a temperature above 230 F (110 C) and then cooled to room temperature.

balanced core—One with the core-seat portion so shaped and dimensioned that it will overbalance that part of the core extending into the metal cavity.

ball mill—A revolving cylinder partly filled with iron balls for grinding or mixing sand, or other materials.

band, inside—A steel frame placed inside a removable flask to reinforce the sand.

band, snap flask—See JACKET, MOLD.

band saw—A saw in the form of an endless steel belt which runs over a pulley.

bars—Ribs of metal or wood placed across the cope portion of a flask. Sometimes called "cleats."

base bullion — Argentiferous lead containing 10 to 60 per cent silver with or without some gold.

base permeability—That physical property which permits gas to pass through packed dry sand grains containing no clay or other bonding substance.

basic—A chemical term which refers to a material which gives an alkaline reaction.

basic bottom and lining—In a melting furnace, the inner lining and bottom composed of materials that have a basic reaction in the melting process—either crushed burned dolomite, magnesite, magnesite bricks or basic slag.

basic pig iron—A special high phosphorus (2.0 to 2.5 per cent), low sulphur (0.08 per cent), low silicon (0.80 per cent) pig iron made for the basic open hearth process for steelmaking.

basic refractory materials—Bodies containing basic oxides which react with acids to form salts, e.g., magnesia, alumina, and lime.

basic steel—Steel melted in a furnace that has a basic bottom and lining, and under a slag that is predominantly basic.

bath—Molten metal held in hearth of furnace during melting process.

battens—Wooden bars or strips fastened to patterns for rigidity or to prevent distortion during ramming of the mold.

(Continued on Page 92)

Muskegon's Hackley School Displays Foundry Students' Work

Varying from machine castings to objets d'art were the products of Hackley Manual Training School's Foundry and pattern shops, displayed in the window of Sears, Roebuck & Co.'s Muskegon, Mich., store as part of the A.F.S. Western Michigan Chapter's effort to stimulate interest in the foundry as a career for young men. At right is shown a representative group of students from Hackley School, whose foundry courses were revived in 1948 after almost two decades' dormancy principally through the efforts of members of the A.F.S. Western Michigan Chapter.

BURNING-IN THE CUPOLA BED

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This paper was presented at a Gray Iron Shop Course Session of the 54th Annual Meeting, American Foundrymen's Society, at Cleveland, May 8-12, 1950.

ALTHOUGH THE IMPORTANCE of correctly burning-in the coke bed has been emphasized in every discussion of cupola operation, it is highly significant that, in the writer's experience, the bed is poorly conditioned in far too many instances. This is due largely to the fact that the men actually starting the cupola have not been properly instructed, and that the bed is rarely checked by the foreman or superintendent.

The phrase "a good start is 90 per cent of a good heat" may be an overstatement, but it serves to emphasize the importance of this phase of cupola operation. Construction of a proper bed is not difficult and there are certain fundamental factors which, if rigorously observed, will make this operation foolproof. The following sections will illustrate these principles, and point out the means of detecting improper conditions and how they can be corrected.

Lighting Up

Although the methods of lighting the initial coke bed vary considerably the intent is the same under all conditions, namely, a uniformly lighted volume of coke of the correct height which will permit the delivery and maintenance of iron at the desired temperature. The methods used are as follows:

Wood: In general some effort is made to lay a wood flooring to prevent puncturing of the sand bottom when the balance of the wood is thrown in. Sometimes the wood is thrown in on this flooring without direction or, if properly done, selected long pieces may be stacked in an inverted cone shape around the circumference to create an open area around the tuyere section.

Oil or kerosene are frequently used to speed up the firing. This is added in the form of saturated burlap sacks laid on the wood floor, or the oil is poured in on the wood from the charging door. This latter practice should be avoided because frequently the oil drains into the sand bottom, resulting in localized burning and drying out with consequent bottom "heaving" later. If wood and oil are used the best practice is to soak several pieces of the wood in oil prior to placement in the cupola and scatter them throughout the wood bed.

The use of wood for starting the fire is losing favor for the following reasons, which will also serve to point out the conditions to avoid if wood is used:

High Cost: Good, dry wood of the proper thickness and length at a reasonable price has become very scarce. Few shops create enough wood for this purpose.

Excessive Time: The process of building the fire is too slow and cumbersome. If properly done the positioning of the wood is quite slow and requires two men—one in the cupola and the second to hand down the wood. Handing down the wood is dangerous to the man in the cupola unless a proper sling is devised, and additional precautions observed.

After the first wood is positioned the balance of the wood is added, and then fired. After the wood is ignited a portion of the coke is added, generally a third to a half of the total used. This is brought to a cherry red, and the second portion is added. This is again fired to a cherry red, after which the balance of the coke is charged.

Wood too Green or Wet: Generally the wood is stored out in the weather, and if it has been subjected to recent rains it will be quite wet, or if new it may be green. In either case the chances of establishing a uniform fire in the coke are slim. This will result in localized hot and cold areas, which will be reflected in the fire conditions when the wind is turned on. If the wood is green the condition may persist even after the wind is on, resulting in cold and "gassy" iron.

Wood too Hard or Heavy: Under these conditions the fire is too slow in starting and the coke is unevenly lighted. This results in a poorly distributed fire condition throughout the coke and non-uniform melting.

Proper Use of Wood

If wood is used the following conditions should be observed: (1) it must be dry; (2) it must not be too thick for complete consumption during ignition time; (3) it should be positioned with care to permit uniform firing of the coke (an inverted cone, positioned around the circumference of the cupola at the tuyere level, will serve); (4) enough wood must be used to ignite sufficient coke to fill the cupola 12 in. above the tuyeres when the coke settles.

Oil: Frequently oil torches are used to start the fire, placing the burners through a couple of the tuyeres or through special ports cut in the base area directly at the sand bottom level. Usually, when the latter practice is followed pieces of large coke are positioned to form a canal on the sand bottom to give good penetration of the flame. This method is preferred to firing through the tuyeres, because it will ignite the bottom coke to a greater extent. After igniting the coke the holes are plugged, usually with a tapered ceramic plug, and a covering plate bolted to the outside shell. Two, three or four points of ignition are used.

The use of an oil torch is advantageous in that most shops have this equipment for drying ladles, usually portable with its own supply tank. The equipment is not expensive, and a sufficient number of torches can be used to start the bed uniformly.

Gas: The use of gas torches follows the same practice as for oil, firing either through the tuyeres or the special bottom ports. Gas is not as convenient as oil, requiring availability and a supply line at the cupola.

In the use of oil or gas about half the coke bed usually is added first. Firing through the special lower ports is more effective than firing through the tuyeres because of the "canals." In both cases ignition is rather slow unless the flame is adjusted to a high temperature (oxidizing).

Electricity: A patented lighter, operating on the principle of an electric arc drawn by a high ampere current, is on the market. Lower ports are installed in the cupola well and a mound of coke breeze ignited by the current; simultaneously air (under pressure) is introduced through a pipe directly onto the ignited coke breeze. The current is on only long enough to ignite the coke to a point where the air will support combustion.

This system is faster than gas or oil because it is easier to ignite the bed at several points. The principal disadvantage of the system is the equipment cost.

Salamander or External Firing: In this system a bed of coke is fired in a special container on the ground. The coke is fired to a cherry red, generally under natural draft conditions, so that it is ready to charge when the sand bottom is completed. The amount of coke so fired must be sufficient to fill the cupola to at least 12 in. above the tuyeres so that the subsequent coke can be properly ignited.

The disadvantage of this system is the extra work involved, particularly at a time when the men are well occupied. It does have the advantage of creating a uniformly lighted lower bed.

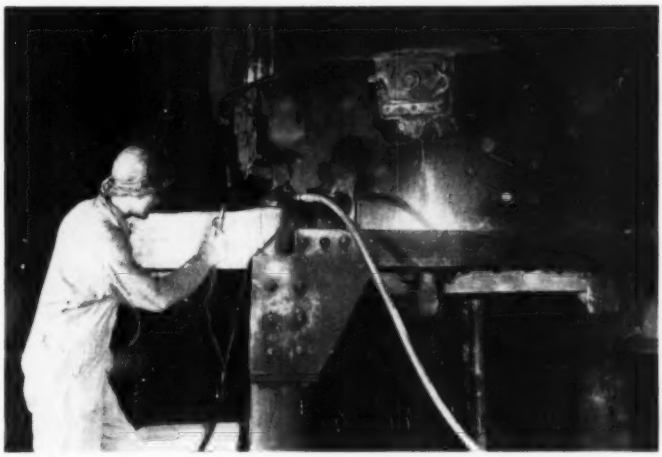
In the foregoing systems all of the tuyeres should be left fully open to give sufficient natural draft for igniting the coke above the tuyeres. The matter of natural draft is very important, and frequently is neglected or ignored. It is not unusual to have a cupola located in a bay of the building in such a manner that only two or three of the tuyeres get the benefit of full draft. Obviously, the bed will fire fast on the draft side and slow on the non-draft side. Even with induced draft (from the blower) proper over-all burning of the coke may not be established at the time the wind goes on for the heat.

If the coke is well ignited at all of the tuyeres the amount of draft to condition the fire equally can be controlled by regulating the size of the openings in the inspection doors of the tuyeres (if installed). Older cupolas where the tuyeres open directly into the wind box cannot be adjusted in this manner.

The use of air from the blower in starting the coke bed has been the subject of considerable discussion and controversy. The advocates of this practice rightly point out that judicious use of this air will speed the bed preparation, and that the amount of air introduced is controllable by both the rate of the blower and the individual openings of the tuyeres. The opponents of the use of air maintain that the danger of overburning the bed is too great. The writer feels that the use of the blower is not only permissible but has the distinct advantage of establishing a more uniform temperature throughout the bed.

Blower air must be employed only under closely observed conditions, and when used in this manner there is no danger of overburning. The use of blower air applies to all of the previously mentioned methods of coke ignition.

All of the foregoing systems can be employed for igniting the coke. The important point is that the coke bed is properly ignited only when the state of combustion of the coke is uniform throughout the bed. This state of combustion is not the same for all cupolas, because the time of fill-up varies. If the fill-up is fast, the bed should be hotter than if the fill-up is slow. The objective is to have the bed at the proper temperature when the wind goes on for the heat. This temperature is correct when iron will show at the tuyeres in ap-



Lighting of large cupolas in the production foundry of the Ford Motor Co., Dearborn, Mich., is accomplished by coke igniters operated with compressed air and electricity (AMERICAN FOUNDRYMAN, *Aug., 1949, p. 48*).

proximately 3-5 min, and the metal temperature at the spout reaches 2800 F in about 10 min.

Unless experience has shown that the natural draft of a cupola will produce a uniform burn-in under all weather conditions, it is advisable to use the blower, particularly if time is an important factor.

It is not possible to specify an air rate for blowing in the bed which will serve all cupolas because of the different quantities of coke required for the various cupola sizes. It can be stated, however, that the proper volume is that which will produce the minimum positive draft through the bed. In other words, with the tuyeres all open, if the gases from the top of the bed show a definite but low flow over the entire area the volume is sufficient to distribute the air uniformly throughout the bed with minimum danger of overblowing. In this manner a fire at the top of the bed (first-half) should show in 5-10 min. If the bed is not uniformly ignited, continue the wind for another 4-5 min, which generally will drive the fire into the areas not burning.

All the tuyeres should be open when the wind is turned on. As the fire drives through the bed it will be possible to determine the areas with the least response, and at these points close the tuyere plates. In this manner the draft needed can be regulated.

After the first bed is thoroughly ignited it should have a volume at least 12 in. above the tuyeres to supply sufficient heat for igniting the remainder of the bed. If the final bed height is to be 60 in., then the next bed coke should bring the height to about 52-54 in. (above the tuyeres). If time permits this coke can be ignited by natural draft; if not, again turn the wind on for about 5 min. and then let the fire soak, which normally will not require over 15-20 min. This bed should be uniformly cherry red (not white) with no dark or dull areas. The remaining coke is then added to bring the height to 60 in. The final bed should be level, and the reason for topping off the last 8 in. is to permit levelling off.

Poorly Ignited Bed

There is no excuse for a poorly lighted bed, but they are common. The result is that as the wind goes on the hottest area will start to melt the iron directly above it. The coke in this area is consumed early and the level of the bed at this point naturally must be lowered. Although we carefully levelled the bed at the start, we quickly caused it to become unbalanced, and not only cold iron but quite possibly oxidized iron can be expected. A poorly distributed fire in the bed will cause a metal temperature drop just as readily as a low bed or low coke charges.

The danger of overblowing a bed when the blower is used is very real. If, due to an insufficient number of ignition points or poor ignition at the points lighted, the fire is too low at certain points, the bed does not respond uniformly to the blower. The tendency on the part of the operator then is to leave the wind on a little longer than is advisable. This will tend to produce overburning at the well-ignited points or the entire bed may be overfired. The latter is undesirable unless the bed is extraordinarily high.

Overburning a bed can seriously affect a considerable portion of the heat, and can ruin a short one. When the wind is first turned on at the start of the heat, the burning of the coke in the bed is the only thing happening. No iron is melting for at least 4-5 min, and for the next 15 or 20 min the average melting rate is quite low. During this period, however, the coke is being consumed at the full rate. For a cupola melting 14 tons/hr this coke burning rate is approximately 70 lb/min, so that for a period of 20 min we have consumed approximately 1400 lb of coke, replacing about 700 lb (from the charges) leaving a net bed loss of 700 lb, equivalent to a bed height drop of 18 in.

If the bed is at the correct initial height but overburned the iron will start to melt very quickly. This will bring the replacement coke down very fast also. The high initial temperature of the coke will cause it to burn faster and the bed level will descend faster than it is replaced, resulting in lowering the bed too far. The metal temperature will subsequently drop and the danger of oxidized iron will be very great. For this reason an extremely hot initial bed requires an abnormally high bed. It is much safer practice to have a slow melting start than a hot, fast start.

Under ideal conditions, if the blower is not used to burn in the bed the time required usually will be about 2 hr from the time the coke is first ignited until the bed is ready for charging. If the blower is used and the bed properly ignited, the bed can be readied in about 1 hr.

Except for extremely short heats in small cupolas bed flux should always be used. Without this extra and early flux the first metal in the well would have no covering or blanket to protect it from the blast. A satisfactory amount is approximately three times the normal amount used on the charge. For average stock and coke a normal limestone requirement is 3 or 4 per cent of the metal charge, which would be 60-80 lb/ton: for the bed the amount would be 180-240 lb.

Coke Bed Heights

It is not possible to establish an empirical formula for pre-determining the proper initial bed height for a given operation, but it is possible to suggest a procedure to the optimum bed height.

Before we establish what a correct bed height would be we must emphasize a very important point—the initial bed represents a height existing only at the time of measurement. While this initial height is important, the inference is all too frequent that a correct bed height will ensure a perfect heat.

This is far from the actual situation because after the first 20 min of the heat the amount of coke per charge and the air input will determine what the bed height will be during the remainder of the heat.

The initial bed height is a function of the coke, the amount of air used (melting rate), and the stock characteristics. It is easily seen therefore that these factors vary so much from plant to plant that a general statement cannot possibly apply.

In general, bed heights today are 15 to 20 inches higher than they were before the war due to lower quality coke and poorer scrap. When pig iron was so short a few years back the beds and splits were made higher than they are now in an effort to correct low carbon conditions.

Coke size will affect the correct bed height. Small

coke, because of its greater surface, will consume the oxygen in the blast faster than large coke under the same blast conditions. This means that the point in the bed at which no oxygen exists will be lower with the small coke and a lower bed will suffice. Under these conditions metal temperatures will be lower. Small coke, therefore, will require a higher blast rate to drive the oxygen up and extend the high temperature zone to increase the metal temperature.

Conversely, large coke has less surface so that the oxygen will drive higher before being consumed and a higher bed is required. Higher metal temperatures and faster melting rates result.

When a cupola is operated at a melting rate faster than normally employed, the initial coke bed and the subsequent coke splits must also be higher. The oxygen is driving higher through the bed, and to avoid oxidation more coke must be used.

Stock Size Effect on Bed Height

Properly sized coke will permit minimum bed height and optimum coke ratios. In most instances all coke less than 3 in. should be removed before charging. The small coke plugs the voids to such an extent that abnormal quantities of coke are required to offset the poor air distribution.

It is quite customary to measure bed heights in inches above the tuyeres. Some plants also weigh and record the amount of coke in pounds required for a given height. If we assume constant cupola dimensions the height in inches indirectly represents the volume. A constant weight of coke, however, does not reflect a constant volume because the weight of the coke per cubic foot varies with size and specific gravity.

Heavy section material notoriously is slow melting in the average cupola, which in turn requires more coke per ton of iron melted. Small, thin material (if not compacted) requires less coke per ton of iron melted. In both instances the rate of heat transfer is effective.

Small, closely compacted material generally requires more coke for proper melting conditions. Such material produces a pressure head in the stock which upsets the distribution of the gases and the heat transfer.

Although the foregoing factors relate more directly to the quantity of coke per charge, we must also adjust the initial bed to the quantity necessary to prevent a drop in temperature (low bed) or too slow a start (high bed) at the beginning of the heat.

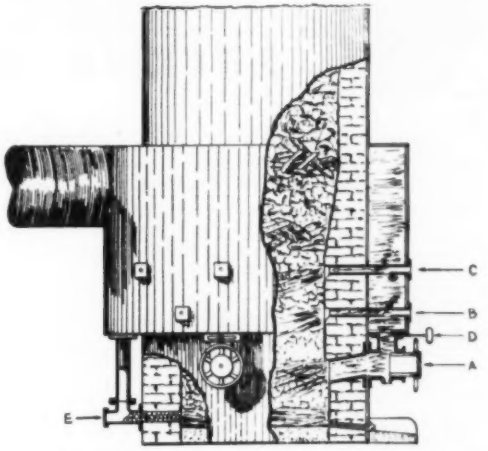
Determine Correct Bed Height

We have shown that it is not possible to specify a definite initial bed height because of the other factors which affect it. An example will serve to show how the proper bed height can be determined.

Let us take a 60-in. cupola (inside lining diameter) at a melting rate of 14 tons/hr with a normal metal mixture (low steel content and sufficient pig iron) and with good stock size. The bed has been properly lighted and burned in. We will estimate a safe height to be 60 in. This will permit us to speed up or slow down the melting rate, if we are out of balance, without seriously disrupting the plant schedule. Using a coke rate of 285 lb/ton of metal charged (7:1), and an air rate of 7200 cfm we find that the time to come up to 2800 F is 30 to 40 min, which is too long.

The following day we will make no changes except to burn the bed in to a slightly higher temperature (between cherry and white) and again note that it took us 20 to 30 min to reach 2800 F. This could be termed perfectly satisfactory operation, but we still may want the high temperature metal a little earlier. For the next day then we will lower the bed to 55 in. and leave the coke per charge the same. Now the temperature reaches 2800 F in 10 to 15 min, which is satisfactory.

If during the balance of the heat we note a gradual slowing down of the melting rate while the temperature remains high enough we can feel that the coke



In the balanced-blast cupola lighting is made easier by the use of lighting tuyeres, shown at (E) in the sketch from A.F.S. Handbook of Cupola Operation, *p. 122.*

ratio is slightly high and the bed is building up. An increase in air will correct this. If this condition repeats itself the coke splits can be reduced by small amounts of 10 to 15 lb/charge until the correct level is reached.

If the bed initially was too low the temperature may reach 2800 F in the desired time but gradually drop and level off, at say 2700-2750 F. This will require a higher initial bed, possibly 65 in., and also an increase in the coke per charge. This latter should be determined only after the correct bed height is found.

Cupolas equipped with hot blast will generally require a lower initial bed and coke per charge. Proper bed height is determined in the same manner as above, starting at lower levels.

Conclusion

Although it has been shown that it is impossible to calculate empirically a correct bed height for any particular operation, the principal factors which determine the bed height have been enumerated and the direction of their influence indicated. If the mode of adjustment suggested is followed and the recommended conditions observed in burning-in the bed, each plant should be able to eliminate the "coke bed" from its list of uncertain operations.

OLD TIMERS of the foundry industry ATTEND 54th CONVENTION

More than 50 "Old Timers" of the foundry industry, each with a half-century or more of service, were present at the 54th A.F.S. Foundry Congress & Show, Cleveland, May 8-12.

In addition to the 50-year veterans, some 300 "youngsters" with from 25 to 49 years' experience in the foundry were on hand to sign the A.F.S. Honor Roll. Both the 25- and 50-year veterans were awarded pins denoting their respective services by Secretary Emeritus R. E. Kennedy, himself a 43-year veteran, who presided at the Old Timers Booth.

Oldest is 75-year Veteran

Top honors both as the oldest foundryman to attend the 54th A.F.S. Foundry Congress & Show and as the longest in point of service to the industry went to William Schneider, 88, of Denver Bronze and Brass Foundry, Denver, Colo., who this year passed his three-quarter century mark as a foundryman. Mr. Schneider attended the Convention with his son, Arthur, 50, and his grandson, Lee, 20, both of Denver Bronze and Brass Foundry. Lee represents the fourth generation of foundrymen in the Schneider family, since his great-grandfather was also a foundryman.

Total foundry experience of this group of old timers attending the 54th A.F.S. Foundry Congress & Show is more than two centuries. Left to right: A.F.S. Past President (1918) Ben Fuller; Dr. H. Ries, chairman of the A.F.S. Sand Division; A.F.S. Past President (1924) Gilliam Clamer; and R. E. Kennedy, Secretary Emeritus, American Foundrymen's Society.

Runners-up for longevity honors were A.F.S. Past National President B. D. Fuller, 86, of Lakewood, Ohio, with 69 years' service; M. E. Dolan, 83, of Louisville, Ky., 65 years; Barnet Bernbaum, 79, of Cleveland, 66 years; Wm. H. McFadden, 81, of Southland Royalty Co., Fort Worth, Texas, dean of A.F.S. Past Presidents (1907), 60 years; Harry J. Lonergan, 75, who began his apprenticeship in 1888 and today is still "in harness" as foreman with Alleyne & Ryan, Cleveland; and Herbert A. Newberry, 75, who still is active in the Newberry Mfg. Co., Talladega, Ala., after 60 years in the foundry.

Past Presidents Hit Half-Century Mark

Four A.F.S. Past National Presidents attending the Convention could boast of a half-century in the foundry industry: Wm. H. McFadden (1907), L. L. Anthes of Anthes Imperial, Ltd., Toronto, Ont. (1909); B. D. Fuller (1918); and Marshall Post, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., (1939).

Dr. H. Ries, 79, of Ithaca, N. Y., head of the A.F.S. Sand Division, and A.F.S. National Director Robert Gregg, Reliance Regulator Div., American Meter Co., Alhambra, Calif., who began his apprenticeship in an iron works on his native Isle of Man, both received their 50-year service pins for the first time at the 1950 A.F.S. Convention.

50-year Roster Is Large

Complete roster of 50-year veterans attending the 1950 A.F.S. Foundry Congress & Show, May 8-12, in Cleveland, listed in order of their signatures on the A.F.S. Honor Roll is as follows:

Herbert A. Newberry, 75, Newberry Mfg. Co., Talladega, Ala., 60 years; H. Ries, 79, Ithaca, N. Y., 50 years; A.F.S. Past National President (1909) L. L. Anthes, Anthes Imperial, Ltd., Toronto, Ont., 54 years; Charles T. Wilson, Oil City Iron Works, Corsicana, Texas, 52 years; Henry M. Oehling, National Malleable & Steel Castings Co., Cleveland, 53 years; Pat Dwyer, 74, Penton Publishing Co., 59 years.

A.F.S. National Director Robert Gregg, 64, Reliance Regulator Div., American Meter Co., Alhambra, Calif.,

50 years; Thomas Cook, 63, Ann Arbor Foundry Co., Ann Arbor, Mich., 51 years; Ed J. Daehn, 65, Pelton Steel Casting Co., Milwaukee, 50 years; Edward Bossert, 71, Maumee Malleable Castings Co., Toledo, Ohio, 57 years; H. Doran, 68, Whiting Corp. (Canada) Ltd., Montreal, Que., 54 years.

W. E. Rayel, 70, Werner G. Smith Co., Cleveland, 56 years; F. W. Burgdorfer, 66, Missouri Pattern Works, St. Louis, 50 years; A.F.S. Past National President B. D. Fuller, 86, Lakewood, Ohio, 69 years; A.F.S. Past President Wm. H. McFadden, 81, Southland Royalty Co., Fort Worth, Texas, 60 years; John Grennan, 69, University of Michigan, 51 years.

John H. McFarland, 66, H. B. Smith Co., Inc., Westfield, Mass., 50 years; Harry J. Lonergan, 75, Alleyne & Ryan, Cleveland, 62 years; John F. Kenny, 64, Des

Reminiscing over several decades of past foundry shows were these veteran A.F.S. Convention-goers. Left to right: Past National President Wm. H. McFadden (1907); Retired A.F.S. Executive Vice-President C. E. Hoyt; Past President (1918) Ben Fuller.

Plaines, Ill., 50 years; Barnet Bernbaum, 79, Cleveland, 66 years; J. McDonald, Babcock, Wilcox, Goldie & McCulloch, Ltd., Galt, Ont., 51 years; M. E. Dolan, 83, Louisville, Ky., 65 years.

James Plachy, 65, Parma, Ohio, 51 years; M. F. Murphy, Brooklyn Graphite Co., Brooklyn, N. Y., 51 years; Wm. A. Bachmand, 68, Elkhart, Ind., 50 years; William Schneider, 88, Denver Bronze and Brass Foundry, Denver, Colo., 75 years; Joseph B. Medley, 67, Tallman Bronze Co., Hamilton, Ont., 53 years; Louis F. Wind, 67, U. S. Reduction Co., Cleveland, 52 years.

H. P. MacKinnon, 77, Great Lakes Foundry Sand Co., Detroit, Mich., 50 years; James Prendergast, 69, Cooper Foundry, Manchester, England, 58 years; Charles O. Hiler, 71, Charles Hiler & Sons, Walkerton, Ind., 56 years; J. F. Steeves, 73, Corbett-Steeves Pattern Works, Rochester, N. Y., 57 years.

R. P. Schneider, 66, Ohio State University, 50 years; David Callander, 62, David Callander Foundry & Mfg. Co., Guelph, Ont.; Philip J. Shire, 65, Tabor Mfg. Co., Philadelphia, 53 years; J. C. Jensen, Battle Creek, Mich., 52 years.

J. Garrard, 66, Ohio Malleable Iron Co., Columbus, 52 years; Earl F. Rogers, 63, Acme Foundry Co., Cleveland, 50 years; E. F. Kipp, 74, F. E. Myers & Bro. Co., Ashland, Ohio, 53 years; Harry W. Impey, Tabor Mfg. Co., Philadelphia, 53 years.

Grinning broadly, H. P. MacKinnon of Great Lakes Foundry Sand Co., Detroit, has his 50-year button pinned on by Georgina Wylie of the A.F.S. Staff at the Old Timers' Booth during the 54th A.F.S. Foundry Congress while A.F.S. National Director Robert Gregg, Reliance Regulator Div., American Meter Co., Alhambra, Calif., who received his 50-year pin for the first time this year, watches with interest.

Charles F. LaDue, 66, A. P. Smith Mfg. Co., East Orange, N. J.; Oliver J. Charette, 69, A. P. Smith Mfg. Co., East Orange, N. J., 52 years; William Jordan, 64, Oliver Corp., Springfield, Ohio, 50 years.

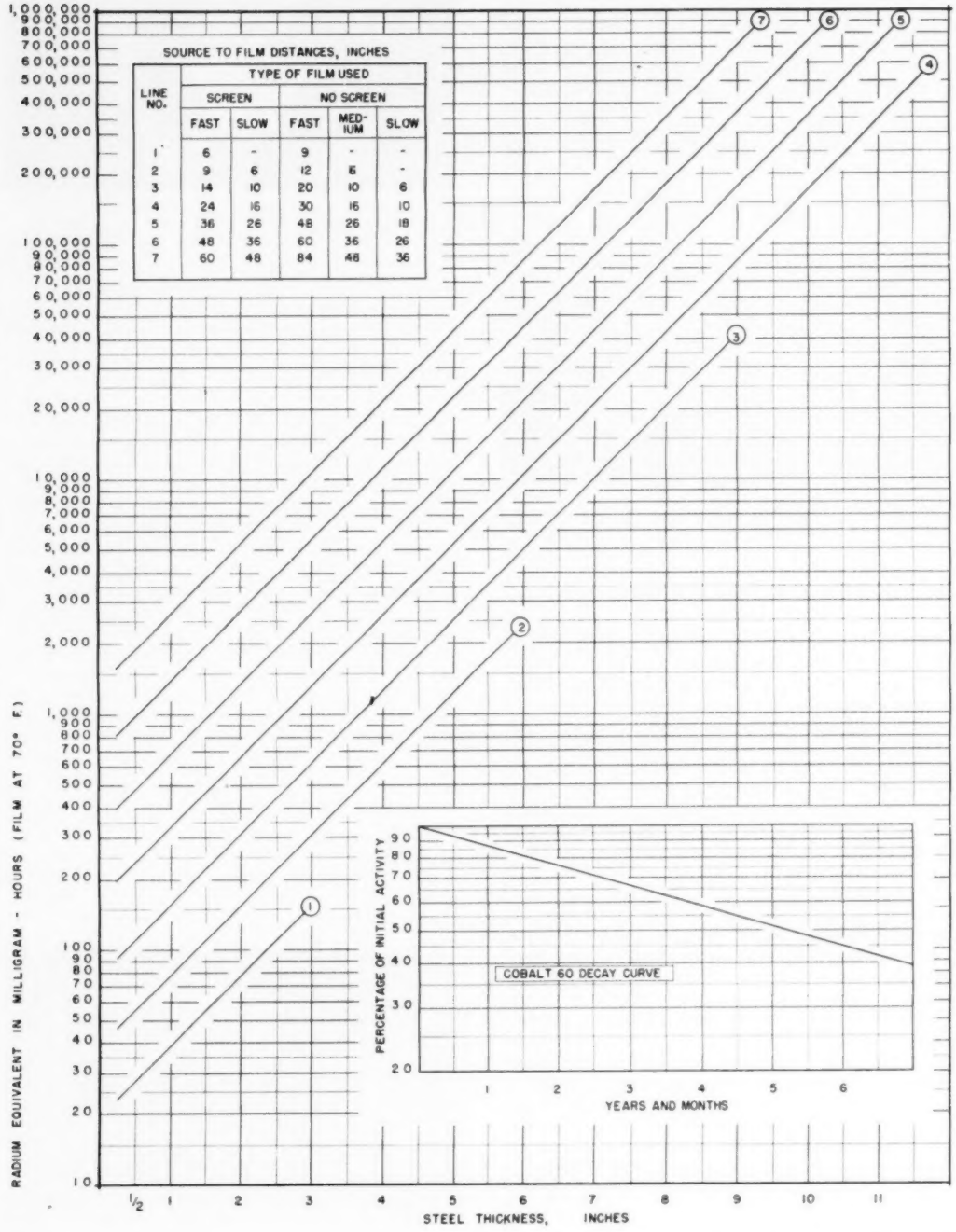
Wm. A. DeSantis, 64, Ace Foundry, Ltd., Los Angeles, Calif., 53 years; J. W. Johnson, 65, Continental Foundry & Machine Co., East Chicago, Ind., Henry V. Adams, 65, Chas. A. Krause Milling Co., Foundry Supplies Mfg. Co., Chicago, 53 years.

Louis M. Bassini, 70, Monroe Steel Castings Co., Monroe, Mich., 52 years; F. F. Shortsleeve, 66, F. F. Shortsleeve Co., Elmira, N. Y., 50 years; O. E. Lewis, 69, Crouse-Hinds Co., Syracuse, N. Y., 50 years; E. T. Doddridge, 77, Rocky River, Ohio, 58 years; A.F.S. Past National President Marshall Post, 66, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., 50 years; Albert B. Schniebel, San Antonio, 50 years.

"Youngsters" Horace A. Deane (left), A.F.S. Past National Director, and Thomas Wood (right) flank 53-year foundry veteran Albert E. Nelson. Prior to retiring this year Mr. Nelson was, like Messrs. Deane and Wood, an executive of American Brake Shoe Co. (Photo by John Bing, Metropolitan Refractories Corp.)

APPLY RADIOISOTOPE—COBALT 60—

DIRECT READING EXPOSURE CHART FOR GAMMA RADIOGRAPHY



TO RADIOGRAPHY OF CASTINGS . . .

Herbert R. Isenburger
St. John X-Ray Laboratory
Califon, N. J.

WITH THE INCREASED USE of cobalt 60 for industrial radiography a simple and yet accurate exposure chart is an essential tool. While the chart published in *Industrial Radiology*[*] was adequate for radium exposures, the low price and availability of cobalt 60 in greater activities and with comparatively small focal spot size, make it possible to radiograph greater thicknesses of steel, use larger source to film distances, and allow longer exposure times than have been commercially used with radium. These factors and certain changes in photographic materials during the past years make it desirable to revise the old chart.

Extensive tests with cobalt 60 are the basis for the accompanying chart (opposite page). In order to permit the use of this chart for radium as well as for cobalt 60, the exposure curves have been established in radium equivalents. Ordinarily, material supplied by Oak Ridge National Laboratory has a ratio between radium and cobalt 60 of approximately 1.55, that is, 1 curie of cobalt 60 corresponds to about 1.55 grams of radium. The decay scheme of cobalt 60 is shown in a separate curve (inset on the chart).

In addition to the radium equivalent, the ordinate of the exposure chart includes the time exposure in hours. Depending upon the type of x-ray film used, the source to film distance is determined by the seven lines. They are figured for a film density of 1.0 H. & D. above the threshold value of each film used. This is necessary since the threshold value varies with each type and make of film, and may even change from time to time as the manufacturer varies the emulsion of the film. It is best to obtain these values from the manufacturer and check with him at yearly intervals.

Setting Up the Film

The arrangement inside the film holder is as follows: Interleaf two films between three lead foils. The two foils which face the source of radiation should be 0.005 in. thick and the back screen 0.010 in. It may be desirable to expose two films of different speeds simultaneously, the faster film to cover the heavier metal sections of the object and the slower one for the thinner sections. For distances consult the table (inset on the chart).

Since gamma ray exposures are usually made in unheated rooms or in the field, we have found it necessary to make the following correction for temperature changes: Add 1 per cent to value of milligram-hours for each degree F below 70 F. For example, increase scaled value by 40 per cent if exposure is made at 30 F, using lead foils. Deduct 1 per cent from scaled value for each degree F above 70 F. The limit of temperature range for the correction is from 20 to 120 F. It is advisable to avoid the use of lead foil screens for long exposures in moist atmosphere.

The following problem may serve to explain the use of the chart: A steel casting, ranging in thickness from 3 to 5 in., shall be radiographed. The critical portions can be covered by a film, size 14 x 17 in. A cobalt 60 source of 350 millicuries strength was purchased 9 months prior to the date of this inspection. According to the decay curve 90 per cent of its original strength is left, and this corresponds to 488 milligrams in radium equivalent.

In order to cover the various cross-section thicknesses in a single exposure, a fast and a medium speed no-screen film are selected for simultaneous exposure at a 28-in. source-to-film distance, using line 4 in the chart for the 5-in. thickness and line 5 for the 3-in. thickness. Selecting a medium position between these two points and projecting it to the ordinate, the exposure time is found to be about 6,400 milligram-hours at 70 F. This would indicate a 13-hr exposure for the available gamma ray source. Suppose this work is to be done at a temperature of 100 F, in which case the time of exposure can be shortened 30 per cent—final exposure time, 9 hr.

The films should be processed in accordance with the recommendations printed on the chemical containers. While the films may be viewed when still wet, a final opinion should not be passed until after the gammagraphs are completely dry. If faint shadows appear that are not quite clear, they may be brought out by immersing the film in an intensifying solution for a couple of minutes. Then wash the film again and view when dry. The intensifying medium is especially recommended to increase the contrast in cases where the films must be printed on photographic paper.

[*] St. John and Isenburger, *Industrial Radiology*, p. 228, John Wiley & Sons, New York, 2nd ed. (1943).

British Brass Foundry Production Team Films Report Of Visit To U.S.

COLOR FILM, "*The Brass Trail*," is the unusual form which will be taken by an official report submitted on their visit to the United States by a 16-man British Brass Foundry Productivity Team.

The 16-mm film is the work of two amateur cinematographer team members—Team Leader Frank Hudson, Mond Nickel Co., Ltd., London, who presented the official Institute of British Foundrymen Exchange Paper at the 54th Annual A.F.S. Foundry Congress, and Joseph Gummer of Rotherham, England.

The 16-mm film, now in final preparation stages, is expected to be the most easily understood of all the productivity team reports thus far submitted.

URGENTLY NEEDED

VOLUME 56 (1948) TRANSACTIONS

Bound copies of this volume in good condition will be purchased by A.F.S. Headquarters. Members who have no further use for their copies are urged to write The Secretary, American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5.

PRECISION ALUMINUM CASTINGS

Hiram Brown
Chief Metallurgist
Solar Aircraft Co.
Des Moines, Iowa

IN GENERAL, five different types of casting processes are used for aluminum: sand, permanent mold, die, plaster, and invesment casting. Centrifugal casting is not listed because it is a method which can be adapted to almost all of the five types mentioned, and will be dealt with in a comprehensive manner.

Each type of casting process has its advantages and limitations, and the same degree of precision can not be expected from each. Precision is defined as "being exactly or sharply defined or stated." Therefore, five types of precision aluminum castings can be expected since if a casting meets the defined or stated requirements for its type—finish, tolerance, etc.,—it must be recognized as a precision aluminum casting.

The trend in the aluminum casting field is changing. Before World War II, 60 per cent of all aluminum castings were sand castings, 20 per cent permanent mold castings, and 20 per cent die castings. Today about 40 per cent of all aluminum castings are sand castings, 40 per cent permanent mold castings, and 20 per cent die castings. Plaster and investment castings have always been a small fraction of total production, but the sizes and shapes cast by these processes make them useful for special work.

In discussing castings, the factors which affect quality or "precision" can be divided roughly into the metal being cast, and the mold or material into which the metal is poured. In general, the recommended practices for obtaining high quality metal are the same for all of the casting processes, so this subject will be discussed only once, and then the various molding processes will be discussed individually.

Quality Metal Required

Sound metal is the most important factor in producing precision aluminum castings regardless of the casting process involved. Good quality starts with the ingot and progresses through melting, degassing, grain refining (if necessary), and pouring.

The starting point for quality metal in castings is the use of metal of known composition. Casting properties of alloys are sensitive to chemical composition. The foundry foreman may be the first to notice "off color" metal because he will have difficulty in maintaining uniform shrinkage and freedom from cracks if the composition of the metal is allowed to vary. As soon as the foundryman knows what alloy he is going to use for a certain casting, he should select a standard specification (such as ASTM) and insist that all metal for casting that job be ordered to that specification.

Then, and only then, should the foundryman begin to experiment with gating. If this is not done, the foundryman will find that the presence of impurities can alter castability of the metal as much as they do the mechanical properties. For example, the presence of magnesium as an impurity in aluminum-silicon alloys, or silicon as an impurity in aluminum-zinc-magnesium alloys, will embrittle the alloys and may cause increased cracking in the mold or alter shrinkage characteristics. Different alloys have different foundry characteristics, and no change in alloy should be made without careful consideration of the effect upon the gating technique in use at the time.

Know Metal Composition

The safest material for melting is ingot because ingots are usually made from heats large enough for analysis, thus permitting necessary correction during remelting. Scrap should be used only if it is of a size that will give good recovery, is of known composition—which means good segregation of scrap at cutoff areas—and is free of oil, grease, and water. Sawings, grindings, borings, or turnings should not be added to the melting pot without being smelted, refined, cast into ingots, and analyzed.

Oil and grease on scrap will cause gassy metal. If scrap is oily or greasy, either degrease it or smelt it and pour it into ingots before use. Moisture on ingots or scrap will not only give gassy metal but may cause spitting or explosion if moist metal is placed in molten metal. Metal should be stored indoors whenever possible. If metal does become moist it should be heated to 900 F or above for a few minutes.

Melting may be done in stationary or tilting pots fired by gas or oil, or in induction furnaces. Iron melting pots may be used for some alloys where iron contamination is not serious. Refractory crucibles such as silicon carbide or graphite may be used for all alloys. Whichever melting method is used, the firing should be indirect so that products of combustion do not contact the molten metal. Melting by direct flame on the metal is not a preferred practice because of the possibility of absorbing gases which may produce porosity.

Fluxing and Degassing

If melting operations have been properly carried out, it may not be necessary to flux the metal; however, some fluxing usually is an important part of melting operations. Solid or gaseous fluxes may be used. Solid fluxes usually are fluorides or chlorides of metallic salts, or a mixture of one or more chlorides and fluorides with cryolite.

Solid fluxes generally are used to separate the metal from the dross so that a dry dross will float to the top of the bath where it can be skimmed off. If gas porosity is present, it will usually be necessary to flux or degas with gaseous fluxes such as nitrogen or chlorine. Since degassing usually results in coarser grain size, it is often necessary to add grain refiners. For that reason many foundries degas with boron trichloride which both removes gases and refines grain size.

Nitrogen usually is preferred for degassing due to its non-toxicity and relative ease and safety of usage compared with chlorine. However, some alloys re-

NOTE: This paper was presented at the Wisconsin Regional Foundry Conference, sponsored by the A.F.S. Wisconsin Chapter and the University of Wisconsin, at Milwaukee, Feb. 9, 1950.

spond only partially or not at all to nitrogen degassing. This is particularly true of alloys containing magnesium, probably due to the tough oxide film formed by the magnesium which effectively traps gas and prevents it from being released by nitrogen bubbles. Nitrogen degassing is believed to be mechanical in nature whereby the gas in the metal diffuses into the bubbles and is carried to the top of the bath. Chlorine, in addition to mechanical action, is believed to effect a chemical reaction which attacks the tough oxide film so that the trapped gas can work its way out.

Due to its chemical action chlorine will also remove some magnesium from the metal, and proper allowance must be made. Chlorine will also demodify high-silicon alloys which have been modified with sodium, whereas nitrogen will not. A common practice in such cases is to first degasify the metal with chlorine, then modify with sodium, and finally flux with nitrogen.

Control Metal Temperatures

Temperature control will also help eliminate porosity. Pyrometers should be used in the melting furnace and on the foundry floor. Open or closed-end thermocouples may be used at a pouring station, or portable closed end-thermocouples any place on the floor. Melting temperature should not exceed 1450 F except in rare cases where thin sections may require a higher temperature.

If fluxing is not used and pinhole porosity would be objectionable from the appearance standpoint, some thought should be given to the alloy used. Some alloys retain gas and the resulting pinholes are visible to the eye. Other alloys retain gas as microporosity, which is visible only by x-ray or microscope. This characteristic of an alloy can be predicted from its constitution. Alloys which form solid solutions with little or no eutectic—such as 214 alloy—do not readily show pinhole porosity; alloys solidifying over a wide range with an appreciable amount of eutectic—such as 122 alloy—can show severe pinhole porosity.

Metal Flow Factors

Formation of oxide films on the surface of molten metals tends to pronouncedly reduce the metal's ability to flow. The presence of undissolved gases within a liquid metal tends to retard flow. Inclusions in liquid metal reduce its capacity to flow. Therefore, to obtain uniform quality the metal must be as free as possible from gas and inclusions.

Gating is an important part of casting. It is frequently possible to increase the strength of improperly gated castings, as determined by actual breakdown tests, by as much as 50 to 100 per cent through the redesign or relocation of gates. All alloys have different fluidity and casting characteristics. Some have greater shrinkage than others. Some have a greater tendency to hot crack, and others dross more readily. All of these characteristics must be known in order to obtain sound castings. Use of x-ray until satisfactory gating is established is a good check of casting soundness. Aluminum-copper alloys with 4 per cent copper, and aluminum-zinc-magnesium alloys are the most susceptible to hot cracking.

If the metal is of good qaulity, then the second factor

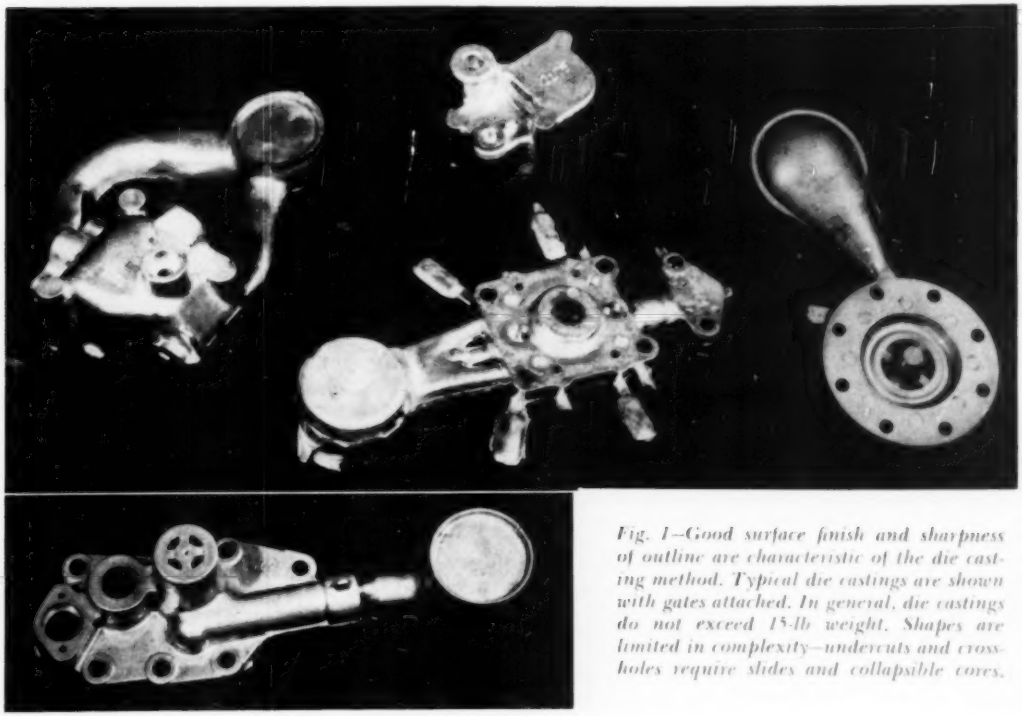


Fig. 1—Good surface finish and sharpness of outline are characteristic of the die casting method. Typical die castings are shown with gates attached. In general, die castings do not exceed 15-lb weight. Shapes are limited in complexity—undercuts and cross-holes require slides and collapsible cores.

which will influence the "precision" of castings is the mold into which the metal is poured. Since each of the processes has quite different mold properties, they will be discussed separately, with a final summary showing the tolerances, machine allowance and finish that can be expected of each.

Sand Casting: As the name denotes, this process consists of pouring metal into cavities formed in sand and allowing the metal to solidify in the mold. The sand may be green (moist) or dry (baked). The green sand usually is referred to as molding sand, while the baked sands usually are cores. Molding sands are sometimes torch dried on the casting surface, but are not baked as are cores.

Aluminum molding sand usually is a natural sand with the following properties: A.F.S. grain fineness No., 140-270; A.F.S. clay content, 10-25 per cent; green compressive strength, 5-8 psi; A.F.S. permeability, 5-30. Natural sands are often used in preference to synthetic sands because of the ease with which they are prepared and conditioned. Fine sands of low permeability will tend to produce blows and gas porosity unless they are properly reconditioned and the moisture content closely controlled.

TABLE 1.—COMPARISON OF SAND AND PERMANENT MOLD CAST TEST BARS FROM SAME ALLOY

Alloy	Casting Method	Yield Strength, psi	Tensile Strength, psi	Elong., % in 2 in.
43	Sand	9,000	19,000	6.0
	Permanent Mold	9,000	24,000	6.0
142-T61	Sand	32,000	37,000	0.5
	Permanent Mold	42,000	47,000	0.5
142-T571	Sand	28,000	32,000	0.5
	Permanent Mold	34,000	40,000	0
355-T6	Sand	25,000	35,000	3.5
	Permanent Mold	26,000	43,000	4.0
356-T6	Sand	22,000	32,000	4.0
	Permanent Mold	24,000	40,000	5.0

Whenever surface requirements permit the use of a coarser grade of sand, a synthetic mix made by combining bentonite and/or fine clay with silica provides a satisfactory material, usually with the following properties: A.F.S. grain fineness No., 70-160; A.F.S. clay content, 3-10 per cent; green compressive strength, 6-10 psi; A.F.S. permeability, 25-120; moisture content, 3-5 per cent.

When a foundry finds a molding sand that gives good results, caution should be exercised in making any change. Not only is grain size important, but grain shape and grain distribution as well. Clays also vary considerably in properties—a definite amount of clay will not give the same result in each case unless it is the same kind of clay. Natural sands from various locations may differ considerably in performance, and all sands should be thoroughly checked before adoption for use.

Core sands usually are clay free. These sands also vary considerably in grain size, shape, distribution, and purity, all of which are important properties. Strength is imparted to the sand by the addition of oils, cereal flours, resin, or other bonding agents and water. The order of adding these elements is important, and a regular sequence of adding the materials must be observed. The recommended procedure is (1) add sand, (2) add dry binders, (3) water, and (4) core oil. The mixing time is also important, and regular mixing cycles for all mixes should be established.

One outstanding advantage of sand casting is that almost any alloy can be cast successfully by use of proper gating. Usually multiple gating is recommended—the metal enters the casting through a number of gates instead of one or a few. This permits lower pouring temperature, minimizing local overheating of the sand and promoting a rapid and progressive solidification in all parts of the casting.

Sand Casting Dimensional Tolerances

Strengths of sand castings are inferior to those of similar alloys cast in permanent molds, due to the slower cooling in sand molds. For the same reason gas porosity tends to be larger in size in sand castings.

Since sand grains often measure 0.006 in. or more in diameter, sand castings must have fairly wide dimensional tolerances. The minimum section thickness which can be satisfactorily sand cast is about $\frac{1}{8}$ in. Surface smoothness and sharpness of outline are much poorer than those of any other casting method.

Sand casting is advantageous for short runs and very large sizes since pattern and tool costs are low, and sand is not an expandable item. Labor costs are high and speed of production lower than that of permanent mold or die casting, except where many small parts can be placed on a single match plate.

Permanent Mold Casting: The process is often called gravity die casting. The molds are made of metal, and metal cores are used except for intricate shapes where metal cores might cause cracking or would be difficult or impossible to remove. In such cases dry sand cores may be used, and the process is called semi-permanent molding.

This process, unfortunately, still retains much of the art about it, and its so-called secrets are jealously guarded by many of the companies using it. Each mistakenly believes his method to be the best, and that he will prosper more if he reveals as little as he possibly can. This is not, in the writer's opinion, the way to expand the progress of the process. The sand casting industry, quite a few years ago, regarded its processes as more of an art than a science. Since shaking off those shackles the sand foundries have made remarkable progress—benefiting by the scientific approach.

Constructing Permanent Molds

In permanent mold casting the molds are very important. A mold alloy must be selected which will withstand the heating and cooling cycles without cracking or checking. This checking or cracking is attributed to the fatigue effect of mechanical stresses which are set up in the die by temperature differences within the mold. Certain steels are capable of withstanding many such stresses, while early failure occurs in others. Inoculated iron is often used, or a heat treated gray iron containing 2 per cent chromium. The metal blocks which are to be made into a mold should be given a thorough stress relief before machining or locked up stresses will cause warpage during machining, resulting in wrong dimensions or poor fit-up.

Molds must be equipped with heating or cooling

TABLE 2—COMPARISON OF DIE CASTINGS AND PERMANENT MOLD CASTINGS OF SIMILAR ALLOYS (AS CAST)

Alloy	Casting Method	Yield Strength, psi	Tensile Strength, psi	Elong., % in 2 in.
43	Permanent Mold	9,000	24,000	6.0
	Die	13,000	29,000	3.5
A108	Permanent Mold	16,000	28,000	2.0
85	Die	19,000	35,000	2.7

systems, since there is an optimum mold temperature for each casting. Molds are usually maintained in the range of 600-800 F. It may be necessary to heat molds for small, thin castings to promote feeding and prevent misruns, cold shuts, and blows; and to cool molds for larger castings to speed cooling rate of the casting and prevent excessive shrinkage and excessive time in the mold. In some cases the mold temperature will be maintained due to the pouring cycle.

One thing is quite definite—the mold temperature must be kept uniform while running any particular part, which means that thermocouples must be embedded in the mold. There is an optimum mold temperature that will result in maximum strength for a given part. This is not necessarily the lowest temperature at which the mold will operate satisfactorily. For example, in one series of tests ½-in. round standard test specimens were cast with mold temperatures of 600-850 F. Sound test bars could be produced anywhere within that range, but tensile properties were better at 750 F than above or below that temperature. This suggests that mold temperature is an important factor in producing high quality permanent mold castings.

Metal cores are often chilled in water between pours to insure rapid chilling and sound metal in those areas. If this practice is followed, standard time in the water and controlled water temperature must be maintained.

Since the molding cycle can affect both quality and cost of the castings, carefully established and closely maintained continuous sequences of pouring and removing castings are vitally necessary. This is true whether molds are hand operated or hydraulic.

Determine Mold Wall Thickness

Since the heat conductivity of the mold is important, some thought must be given to the thickness of the mold wall. There is much disagreement about this; however, by the rule of thumb method mold wall thickness should be three to four times the thickness of the casting, but not less than ¾ in. nor over 1½ to 2 in. Ribs and flanges to strengthen the mold are cast into the back of the block. Life of a permanent mold is estimated at 30-80,000 pourings.

One of the trickiest elements in permanent molding is the coating of molds. So far this appears to be more of an art than a science. It is difficult to determine the kinds of coatings various foundries use and how they apply them. The coating offers control of insulation and gives smooth finish to castings. Although many proprietary coatings are available, most foundrymen prefer to mix their own. All other things being equal, probably any of the coatings would give good results. Common washes are made of French chalk, china clay, whiting, talc, asbestos, mica, graphite, rouge, or fireclay—used alone or in combination, plus water and sodium silicate for bond.

Sand blasting the mold and heating to 600-800 F before applying coating is helpful. A good coating properly applied should last all day with only localized patching required. Several thin coats are better than one thick coat. Thinner layer thicknesses may be used at heavy casting sections to promote cooling, and heavier thicknesses at thin sections or gates to promote feeding. The washes are usually sprayed on, and sometimes it is found desirable to mask certain sections during spraying to control coating thickness.

Castings removed from the mold should preferably be placed in a warm place rather than directly on a cold floor. This will bring about a partial anneal, and the tendency of the casting to crack due to rapid temperature change while it is unsupported will be decreased. Castings should be placed in such positions that gates do not act as fulcrums and promote cracking.

Permanent mold castings differ from sand castings in that the greatest dimension usually is in the

Fig. 2—Plaster molds are suitable for medium production runs of castings requiring good surface finish and which would involve excessive machining if sand cast.

vertical position, while in sand casting it usually is horizontal. This changes the gating technique required. Due to the fact that the molds are of metal, it is much more difficult to alter gating than in sand casting. This means much more care in design, and coordination of mold design engineer and foundryman before mold prints are drawn.

Due to the faster chilling of the metal mold, the casting has finer grain size and higher strength than similar alloys sand cast. Comparisons of several alloys, sand and permanent mold cast, are shown in Table 1.

Rapid solidification also reduces the size of any gas porosity present and renders it less visible than in sand castings. However, because of the rapid chilling action of the metal mold, fluidity of the metal is of greater importance than in sand casting. Also, the unyielding nature of metal molds and cores tend to promote hot cracking unless alloys are carefully chosen. These last two characteristics mean that fewer alloys can be successfully cast in permanent molds than is the case in sand casting.

Due to the fact that molds are simply open and shut and cores inserted or withdrawn, much of the operation can be done automatically. Thus, production rates are higher than those of the sand casting process, and labor costs are lower. Also, since the impression in the die remains relatively unchanged, scrap is low and uniformity of parts is much greater than in sand castings. This can mean considerable saving in set-up

time if permanent mold castings are to be machined.

Finish, sharpness of outline, and tolerances are much better for permanent mold castings than for sand castings. Mold costs are high but, generally speaking, parts required in lots of 1,000 or more per year will justify consideration of permanent molds. Minimum wall thickness cast is usually 3/32 in.

Die Casting: A die casting is formed by forcing liquid metal into a die or mold and maintaining the pressure until solidification is complete. The two principal methods of die casting are gooseneck and cold chamber. Sandell gives the following basic differences between the two methods. "In the gooseneck process, the injection of molten metal depends entirely upon the pneumatic pressure exerted upon the surface of the molten metal. The effective pressure is only instantaneous and the continuity of the pressure is nullified as soon as the die cavity is filled, because the maximum air pressure is not great enough to exert a squeezing action on the freezing alloy while it is still in the plastic state. About 600 psi is the maximum pressure exerted in this process.

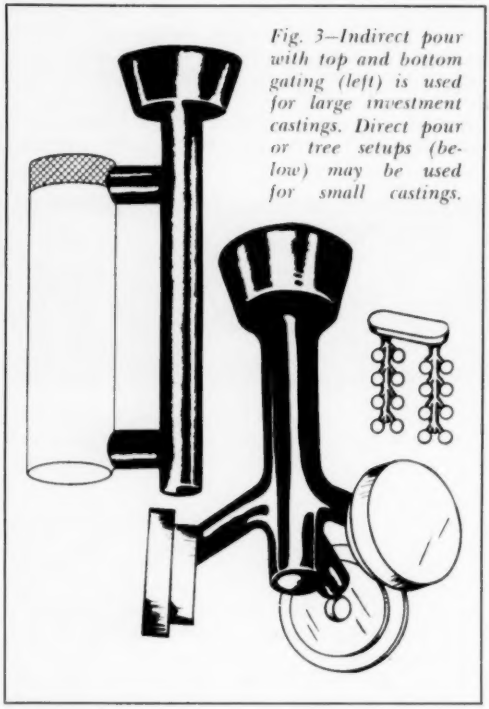


Fig. 3—Indirect pour with top and bottom gating (left) is used for large investment castings. Direct pour or tree setups (below) may be used for small castings.

"Cold chamber mechanism consists of a pressure chamber fitted with a hydraulic power ram. The chamber must be filled with sufficient molten metal to fill the cavity, runner, and gates, and provide a sufficient excess for each shot made. The real advantage in utilizing this mechanism lies in the effective continuous squeezing pressure that can be set up so that the freezing alloy can be compacted as long as it remains in the plastic state. In excess of 30,000 psi pressure is being used, and the maximum depends only on the locking capacity of the machine."

In the cold chamber machine the object is to keep the alloy so close to its melting temperature that although sufficiently liquid to be ladled it is really in a slushlike form. This not only reduces iron pickup but lowers the temperature differential between the die and the metal. In consequence, less shrinkage of the casting results, casting stresses are reduced, and voids are less likely to occur as a result of shrinkage, especially in thick sections.

Since die checking or cracking is a problem attention must be given to the metal used for the dies. The alloy steel used for this purpose usually contains 5 per cent chromium, 1 per cent molybdenum, and 0.4 per cent carbon. It is heat treated after machining to harden it, and should make from 50,000 to 500,000 castings.

Since metal must be forced into the die under pressure its viscosity is an important factor; therefore, almost all aluminum die casting alloys contain at least 1 per cent silicon. The die casting process is not as sensitive to hot cracking alloys as is the permanent mold process.

Die temperature should be closely controlled, usually 400-500 F. Dies made in one piece, whether steel or alloy iron, have in general a longer life than those built up of separate inserts. Die coatings are used to prevent alloying of die casting metal with the die.

As-Cast Strength Is High

The as-cast strength of die castings is higher than that of the same alloy cast in permanent molds (Table 2). However, due to the fact that most die castings contain entrapped gas, blisters develop during heat treatment and the as-cast strength must be considered, whereas permanent mold castings can be improved in strength by heat treatment. High injection pressures are necessary before porosity can be eliminated.

High pressure injects alloys into thin sections of the remote parts of large and intricate castings rapidly and completely. Thus, much more complex castings and those with more and closer work are possible than in permanent mold casting, but use of sand cores is not feasible in die casting. Furthermore, die casting shapes are limited in complexity—undercuts and cross-holes cannot be included unless the dies embody expensive slides, collapsible cores, etc.

Sections as thin as 0.020 in. are not uncommon. Thick sections are seldom, if ever, employed in die castings, and a maximum of ½ to ¾ in. is usually the commercial limitation. Die castings do not usually exceed 15 lb in weight due to expensive dies and the larger casting machines necessary.

As is the case with permanent molds, much thought must be given to design before the die is made, since the dies are costly and difficult to alter. Since the die cavities are of metal, the castings are uniform from piece to piece and scrap loss is low. Surface finish and sharpness of outline are excellent. Figure 1 shows typical die castings with attached gates.

Due to cost of dies and die casting machines, large production runs are required before die casting is feasible. Die casting should be considered when (1) quantity of parts is considerable; (2) tooling for machining is expensive; (3) if machining or surface finish-

ing is an appreciable part of the cost of the finished article; and (4) a reduction in the investment in machine tools and plant floor space is desirable.

Plaster Casting: In its essentials, plaster casting is similar to sand casting. The mold can be made entirely of plaster or of sand bonded with plaster. A pattern and cope and drag molds are used, as in sand casting. Water is added to give strength to the mix and provide sufficient fluidity to pour around the pattern and lie intimately against it to give good surface reproduction.

The added water must be driven off before the castings can be poured. Long-time heating at 600-700 F, or shorter times at 1000-1100 F are used; in either case, blows will result if the mold is not dried thoroughly. Sometimes it is desirable to heat in the 600-700 F range and then hold for several hours at 1000-1100 F. Permeability of these mold materials is very low, although some are reported to be quite permeable. One way to assure adequate baking is to place a fine gage alumel-chromel (welded ends) thermocouple in the center of a typical mold and attach it to a potentiometer so that the mold temperature can be noted. The heating cycle should be based on the time required after the center reaches the desired temperature.

Since the permeability of plaster molds is less than that of sand molds, adequate venting is required for escape of gases during pouring. Powdered fibrous gypsum or talc is often mixed with plaster to increase permeability. Protective coatings must be used on wood patterns to withstand the moisture of the plaster mixes.

Because of the insulating properties of the plaster, cooling of the metal is slower than in sand molds. Therefore, grain size tends to be coarser and porosity is a problem. Where sand is mixed with plaster and water, rate of cooling is faster than in an all-plaster mold. This tends to produce castings which are sounder, finer grained, freer from internal shrinkage, and of higher physical properties than castings made in all-plaster molds. Tensile properties equivalent to those of sand castings can be obtained. Large castings can be made successfully. The largest aluminum plaster casting reported is a 2,200-lb tire mold.

Metal Temperatures Affect Properties

Gates may be smaller than those for sand castings, but blind risers or shrink bobs should be provided to adequately feed the casting. Temperature of the metal is important. Experiments showed that dropping pouring temperature of certain alloys from 1350 to 1300 F increased yield strength 6.5 per cent, tensile strength 9.5 per cent, and elongation 125 per cent.

Since, contrary to sand, plaster is expendable, mold costs are higher for plaster casting. Finish and sharpness of outline are excellent. Walls of 1/16-in. thickness can be cast. The process seems especially attractive for medium-run pieces which could not absorb the cost of metal molds, but which would involve excessive machining if made in sand molds. Figure 2 shows several plaster mold castings.

Investment Casting: This process has also been called "precision casting" and the "lost wax process." These names are unsatisfactory since "precision casting" is only a relative term and is too often misunderstood, and since other types of patterns besides wax are used, the term "lost wax" no longer applies. An investment casting has been well defined as "A metal casting process employing an expendable pattern in conjunction with an unparted or one-piece mold. The mold is made of ceramic material which completely covers the pattern and has no line of separation.

The investment usually consists of a mixture of silica and gypsum. Numerous satisfactory proprietary mixes are available and usually contain about 70 per cent of 200-mesh silica and 30 per cent gypsum. About 33 per cent water is added to make the mix fluid enough to be poured around the patterns and lie intimately in order to give good surface detail.

Numerous types of materials have been used for patterns, among which are wax, plastic, low-melting-point metals, and mercury, but only wax and plastic have had large commercial usage. Wax is fragile and easily chipped or broken. Plastic is harder and subject to less breakage in handling. However, wax patterns can be patched with a hot needle, knife blade, or small soldering iron, whereas plastic cannot be so easily repaired.

Wax has high volumetric shrinkage in solidifying, and has four times the co-efficient of expansion of plastic. Wax costs about three times as much as plastic and must be carefully blended, whereas plastic does not require blending. Wax has a low melting point (170 F) and can be hand or machine injection molded.

Plastic requires high pressure machine injection. Polystyrene plastic softens at 200 F, and flows under its own weight at 400 F. At 600 F it will run rather freely, but never becomes a true liquid. It burns out at 750 F. At 180 F it has a critical point where rapid expansion takes place. Molds must not be held around this temperature if they contain plastic patterns, and in burning out the plastic the mold must be heated rapidly through this range or the expansion of the plastic will cause mold cracks.

Wax patterns can be made in soft metal dies, whereas plastic patterns require steel dies. It is usual, there-

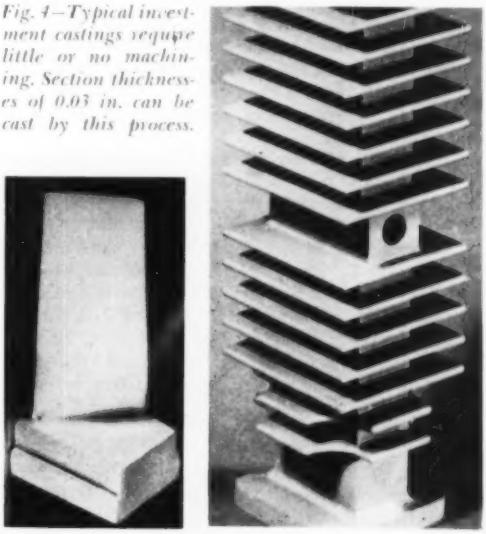


Fig. 4—Typical investment castings require little or no machining. Section thicknesses of 0.03 in. can be cast by this process.

fore, to use wax patterns for small runs and plastic patterns for longer runs. Minimum run for plastic patterns is about 5,000 pieces. In making dies for plastic patterns the machinist must realize that sprue and runner dimensions are as important as the casting portion of the die.

Plastic patterns with heavy sections should be quenched in cold water after removal from the die to prevent shrinkage and distortion. However, the patterns must be firm on the outside before quenching.

After patterns are coated with the investment the molds are dried for several days to remove the bulk of the water. Where wax patterns are used, a drying temperature of 200-220 F is employed because it also melts out the wax patterns. With plastic patterns the drying range is 140-160 F to avoid the 180 F critical expansion of the plastic. After drying the molds are

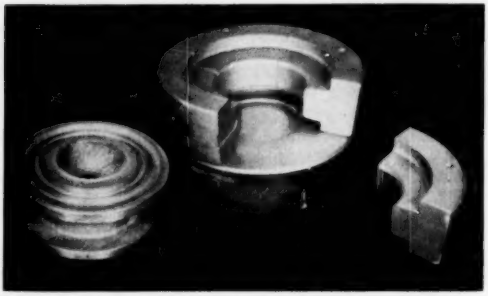


Fig. 5—The centrifugal casting process is limited to the sizes and shapes of parts adaptable to it, such as the casting shown with the mold used to produce it.

heated to 1000-1200 F for 2-4 hr to remove the remaining moisture, burn out the plastic, and burn off residual carbon.

Addition of oxygen to the furnace at this time is helpful in oxidizing the carbon residue and giving a clean, white mold. When plastic patterns were used instead of wax, it was found that more rapid heating could be employed, with a consequent 40 per cent reduction in heating time and 50 per cent reduction in soaking time (wax required a 4-hr soak, and plastic a 2-hr soaking period).

Metal at temperatures above 2050 F should not be poured in this type of investment or the plaster will break down, destroying strength and sometimes chemically reacting with the metal.

Stainless steel flasks of not less than 0.060-in. thickness should be used. During experiments, flasks of 0.037-in. thickness gave more flash and fins than did 0.060-in. flasks. Round flasks gave less flash and fins than did square flasks of the same material thickness. At least ½ in. of ceramic should be used between the side of the flask and pattern, ¾ to 1 in. from bottom of mold to patterns, and ⅛ to ¼ in. between patterns or rows of patterns.

Metal may be poured statically, or a pressure head of about 20 lb supplied. Shrinkage may result if feeding or pressure is not adequate. Due to low permeability of the mold, adequate venting must be allowed.

TABLE 3—TOLERANCES OF CASTINGS

Casting Process	Tolerances, in. plus or minus
Sand	$\frac{1}{32}$ to $\frac{1}{16}$
Permanent Mold	±0.010 to ±0.020
Die	±0.002 to ±0.005
Plaster	±0.002 to ±0.005
Investment	±0.003 to ±0.005

Tensile strengths equivalent to those of sand castings may be obtained if proper gating and proper mold and metal temperatures are used. Some alloys are sensitive to mold and pouring temperatures, and others are relatively insensitive. Usually, around 1300 F is a satisfactory metal temperature, and room temperature to 400 F for molds. If molds are cooled to room temperature for pouring, they must not be allowed to stand long or they will pick up moisture, in which case they must be heated to drive off moisture.

For small castings, direct pouring or tree setups may be used (Fig. 3). For large castings over 1½ in. thick or over 3 in. high or long, indirect gating will give better results (Fig. 3). Surface finish and sharpness of outline are excellent.

The chief advantage of the process is in casting small parts whose extremely intricate shapes make it almost impossible to manufacture them reasonably by any other process. Little or no machining is necessary. Wall thicknesses as low as 0.030 in. can be cast. Figure 4 shows typical investment castings.

Centrifugal Casting: This is a collective term since the process can be used with sand, metal, plaster, or investment molds. The process makes use of a rapidly revolving mold and a cover with a hole through which metal is poured. The castings may be poured in either vertical or horizontal position. One casting can be made at a time or a large number can be cast on a spinning table with metal poured at a center sprue, all molds gated from the center sprue, or castings can be stacked vertically about a sprue.

Metal molds are used where (1) large quantities of identical castings are to be made; (2) the outside contour of the casting is simple enough to be readily slipped out of the mold; (3) a fast cooling rate from outside inward is desirable, with attendant fine grain.

Sand lined molds are used where (1) the metal must flow a relatively long distance over the mold surface; (2) the shape of the casting is such that the mold must be broken down in order to remove the solid casting; (3) relatively uniform cooling rate through a thick section is desirable. Higher speeds are necessary for sand molds than for metal molds.

Thin Sections Cast Centrifugally

Centrifugal casting is of primary advantage for thin sections which cannot be cast statically, or for castings which have a low ratio of finished castings to metal poured when cast statically. If solid castings can be statically cast with a high yield, there is no need for centrifugal casting of those parts.

Centrifugal castings have good soundness. Surface appearance is superior to sand but inferior to plaster, permanent mold, or die casting. Strength is inferior to permanent mold or die casting. Tool, pattern, and mold costs are low, ranking next to sand casting. Tolerances and sharpness of outline are inferior to die,

permanent mold, or plaster casting, but superior to those obtained in castings.

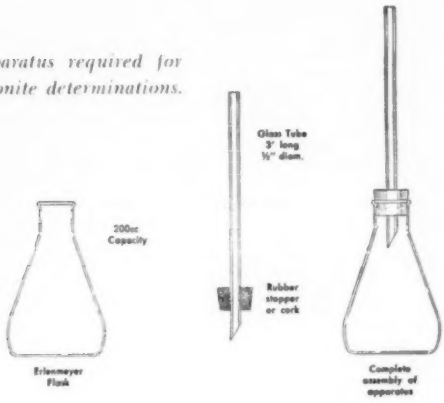
The process is limited as to sizes and shapes adaptable to it, expense of installing and maintaining spinning machines, and increased difficulty of changing equipment to make a variety of castings. Fig. 5 shows a centrifugal casting and the mold which produced it.

Tolerances: If the accepted practices for the various processes have been observed, the castings should meet the tolerances shown in Table 3.

Gilsonite Percentages In Molding Sand Determined By Solvent Method

A simple and accurate method for the determination of gilsonite in foundry sands has been developed, according to J. A. Gitzen, Delta Oil Products Co., Milwaukee. Used as a sea coal replacement, gilsonite gradually builds up in the sand mix. Periodical checks are made to determine the daily additions required to keep the gilsonite content below one per cent, generally within the range 0.50–0.75 per cent.

Apparatus required for gilsonite determinations.



Gilsonite is completely soluble in a 1:1 mixture of benzol and carbon tetrachloride. In the following extraction method, every trace of gilsonite can be removed and accurately weighed after the solvent has been evaporated.

Method: Place 10 grams of dried molding sand containing gilsonite in a 200-cc Erlenmeyer flask. Add 30-cc of benzol and 30-cc of carbon tetrachloride. Boil the mixture of sand and solvents for 5-10 min, using an air condenser to prevent excessive evaporation of solvents.

After boiling, filter immediately through filter paper and wash sand residue with 50-cc of 1:1 benzol and carbon tetrachloride. Collect filtrate and wash solvents in a 250-cc breaker, place on a steam bath and evaporate to dryness. Weigh gilsonite as a residue in the breaker after evaporation of solvent.

Example: A 10-gram sample of molding sand is extracted and the solvent evaporated, leaving a residue of 0.05 grams of gilsonite:

$$\frac{0.05 \text{ grams} \times 100}{10\text{-gram sample}} = 0.50 \text{ per cent gilsonite in sand.}$$

Richard G. McElwee Dies

R. G. McElwee

A.F.S. Gold Medalist and chairman of the A.F.S. Cupola Research Committee, Richard G. McElwee, manager of Iron Foundry Division, Vanadium Corporation of America, died June 21 while on a business trip to his company's plant at Niagara Falls, N. Y. For many years active in A.F.S. technical committee work, Mr. McElwee was awarded the John A. Penton Gold Medal at the 52nd Annual A.F.S. Foundry Congress for "outstanding contributions to the dissemination of information to the foundry industry, especially his splendid efforts on behalf of the Cupola Research Project."

Mr. McElwee made frequent appearances as a speaker before A.F.S. chapter, regional and national meetings on gray iron foundry practices and on cupola practices and research. He was immediate past chairman of the A.F.S. Gray Iron Division.

Born March 11, 1890, in Williamsport, Pa., Mr. McElwee was identified with the foundry industry for more than 30 years. Beginning his career in 1915 as chief inspector for the Muncie Foundry & Machine Co., he served in executive capacities with General Motors Corp., American Car & Foundry Co., Whitehead & Kales Co., Ecorse Foundry Co., and at the time of his death, as manager of Iron Foundry Division, Vanadium Corporation of America.

In addition to his long and distinguished service to the American Foundrymen's Society as chairman and a member of many of its technical committees, Mr. McElwee was prominent in technical work of the American Society for Metals, American Society for Testing Materials, and the Society of Automotive Engineers, frequently appearing before meetings of those societies as a speaker on gray iron founding.

Issue New A.F.S. Committee Roster

Recently published, copies of the 1949-50 *Roster of A.F.S. National Committee Personnel* have been mailed to officers and directors of the Society and to committee chairmen and members. Additional copies will be mailed in the near future to all Company and Sustaining Members of the Society.

As in previous editions, the 1949-50 Roster lists all committee personnel both under their respective Division or General Interest Committee headings and alphabetically. Also included are suggestions for committee selection and administration and suggested rules for Division and committee procedure, including appointment of advisory groups, makeup and procedure for executive committees and standing committees, subcommittees and officers. Briefly described are committee appointment procedure and A.F.S. representation in other societies.

ESTABLISH FOUNDRY CONTROLS THROUGH LABORATORY SERVICES

In recognition of the trend toward more rigid specifications for foundry products, the A.F.S. Cupola Research Committee has prepared or secured articles dealing with closer control of the foundry processes. The present article is the eleventh in the series sponsored by the Cupola Research Committee for publication in the *American Foundryman*.

FOUNDRY PROCESS CONTROL is reflected in the percentage of castings rejected, and in the uniformity of the castings passing inspection. In a large foundry producing 2800 tons of iron in approximately 18 hr a 2 per cent loss would be 56 tons, as much as many smaller foundries cast in a day. The desirability of reducing even such a loss has induced the larger foundries to establish laboratories which conduct chemical, physical, microscopic and radiographic analyses.

These organizations are in a position to determine the characteristics of any phase of casting, and can establish controls which will increase the yield. Smaller foundries, however, may not be in a position to make an investment in laboratory equipment and maintain trained personnel. Hence, they must look to commercial laboratories to provide the analytical tools necessary to establish better practices.

Fundamentally, control is the regulation of a variable within definite limits. The limits cannot be assigned unless quantitative numerical data are available to show the variations that occur. As an example, we may charge a definite amount of silicon into the cupola and tap iron with numerically the same silicon content each time, but the total carbon content will be found to vary. This variation may be due to a difference in tapping temperature, coke characteristics, etc. Regardless of the factor that may cause such a variation, it is only important to know the magnitude of it. Without this knowledge control cannot be achieved.

Apply Chemistry Specifications

Limits are usually set by analyzing many samples obtained under a given set of conditions. Hence, a chemistry specification is applied to a casting after it has been ascertained that the casting made of an iron of a certain chemical composition possesses the desired physical properties and performs satisfactorily in service.

After a limitation has been assigned it becomes necessary to stay within the designated limits. This, again, can be accomplished only by an analytical procedure that gives quantitative numerical data.

Too often foundries submit for chemical analysis only one sample from a day's heat taken at a given hour. The expense of such analytical work might better be saved inasmuch as it only gives the analysis of the iron at a particular time in the heat and tells nothing about the rest of it. It might then be proposed that if the iron is within permissible limits at a given time, the rest of the heat should be acceptable.

However, it should be remembered that changes within the cupola take place in a matter of minutes and can be disclosed only by a systematic method of checking. That is, samples for analysis must be taken at definite intervals throughout the heat. Foundries possessing laboratories can do the analytical work simultaneously while those that do not must wait the customary time for the commercial laboratory to complete such work. The result obtained should preferably be plotted on cross-section paper to determine the magnitude of the variations and the character of the operation. To illustrate this point such a log has been plotted (Fig. 1).

It will be noted that the heat analyses did not stay within the designated limits. The total carbon content of samples taken in the early part of the heat is higher than required, while the total carbon content of iron tapped in the latter part of the heat is below the amount required. It is also noted that the silicon did not remain within the limits. The properties of the iron during casting will vary, as will the castings after shakeout. This is not desirable in controlled foundry practice and should be adjusted as soon as possible.

Check Coke Charges

A cupola operator, after looking at such a graph, might investigate the bed practice. The cupola bed may have been high at the beginning of the heat and was not replaced with sufficient coke on the after-charges. On the other hand, if the after-charge coke weight is believed to be correct, one should investigate the scales to determine if they are out of adjustment. Whatever the cause, the log is the basis of change and readjustment. By changing one item at a time it is possible to trace the cause of the irregularity and correct it.

After each change a new log should be made and ample data must be recorded to enable the analyzer to draw the right conclusion. After all factors have been adjusted and the product is obtained as desired, logs should be made with each major change in raw materials, new equipment, etc. This procedure permits the operator to maintain uniformity of product and minimum loss due to defects.

Another example shows how a commercial laboratory helped a foundry which casts large automotive dies. A few of these dies were cast from a heat that appeared to be normal, and were shipped to the customer. The customer refused to accept them because they were too hard for machining. Foundry personnel could not explain the cause of this excessive hardness. The usual rail, scrap, and pig iron had been charged into the cupola. Records showed that chills measured 5/16 to 3/8 in. in depth.

Samples of the iron from the hard dies were taken to a commercial laboratory for examination. Metallographic examination showed a structure with excessive carbide formations and a normal graphite

pattern. The iron was then analyzed chemically for chromium and manganese contents. If was found that the iron contained 1.4 per cent manganese, which probably accounted for the major part of the hardness.

The problem then became one of locating the source of the large quantities of manganese. Samples of steel and cast iron scrap were submitted for chemical analysis. The analyses showed that the steel scrap contained about 1.5 per cent manganese, accounting for the excessive amount present in the iron. The scrap was segregated and used in place of briquettes to bring up the manganese content in the iron.

From time to time casting defects are accentuated in the foundry. In some cases it is found that segregations occur, and the usual procedure is to remove the segregation or a piece of the casting containing it and analyze for metal components. Such analyses point out poor inoculating or alloying techniques, poor skimming practice, poor solution of alloys due to low temperature, etc., which can be corrected to reduce losses of castings.

Many foundries are experimenting with nodular iron. The quantity of magnesium necessary for nodulation is of the order of 0.06 per cent magnesium remaining in the iron. Many foundries mail samples of these irons to spectrographic laboratories, receiving the analyses by telephone, confirming reports being sent later.

In several foundries excessive slag notch trouble has been encountered. Inasmuch as slag analyses are complicated and tedious and the chemicals for such work are not readily available in laboratories running routine metal analyses, slags have been sent to commercial laboratories. The analyses can be used as a basis for adjusting the limestone or siliceous material additions, thereby eliminating some of the slag notch difficulties.

During the coke shortage cokes were purchased from every conceivable source. It was noted on various occasions that sulphur pick-up was abnormally high. For best use such cokes had to be segregated, and the segregation could be carried out only on the basis of an analysis for sulphur content.

Analyze Incoming Materials

The matter of incoming material analyses should not be omitted in this discussion. Questions arise as to whether materials received are as ordered or meet the purchase specifications. Some foundries are not equipped to conduct all forms of analysis, and a commercial testing laboratory may save time and expense in analyzing items falling outside the usual routine.

The examples cited thus far have dealt largely with metal components as determined chemically. In the future irons may be bought on the basis of microstructure rather than on chemical analysis. Metallographic analysis not only permits one to view the microstructure but to note such things as segregations, excessive carbide formations, and graphite form and distribution. A very large graphite flake may indicate that cooling has been very slow in the section cast. It might also mean that the metal analysis is not suitable for the section involved.

Phosphide formations have been studied using the metallographic technique. Manganese-sulphide segregation or stringers in high-sulphur irons has also been detected by this means. Their elimination usually means the readjustment of analyses.

The tendency today is toward faster machining rates. Thus, there is greater insistence on ferritic structures and the elimination of pearlite and carbides. To meet such a specification might require many metallographic examinations, and the situation may compel the foundryman to make them a routine procedure. In this case representative samples would have to be picked from a day's heat or from the castings poured from each ladle. Castings found not to be ferritic to

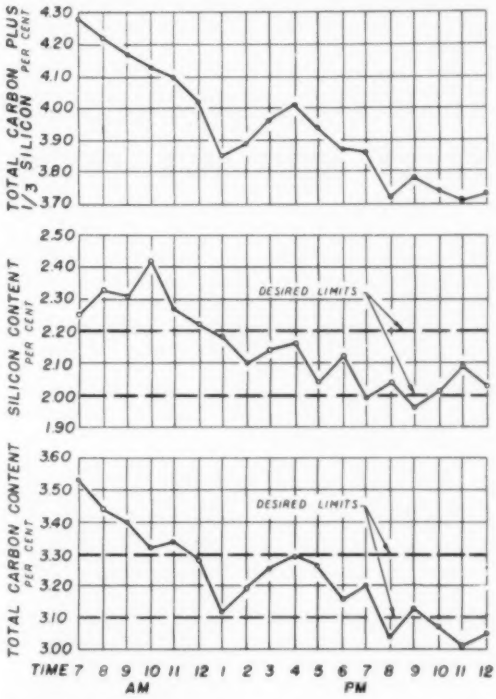


Fig. 1—Analytical results are plotted to show degree of variation in total carbon and silicon contents in a heat, and the character of the cupola operation.

the desired degree might be put through a heat-treat cycle, or the practice could be changed to include an inoculating practice that would help such structural formations.

Physical testing is the third phase of laboratory work. Some customers require that test bars be poured at the time castings are poured. They may require transverse or tensile strength determinations which are correlated with the design requirements of a casting. Commercial laboratories are equipped to machine such bars to ASTM specifications, and usually are in a position to make all of the physical strength determinations. If required, these results may be used as a certification for the castings that the samples represent.

Another example shows how physical testing can

demonstrate the desirability of one iron over another. Not long ago a machine manufacturer wanted to increase his rate of production and was seeking other sources for castings. He contacted a foundry which stated that they would make these castings from their usual high-carbon, relatively low-silicon iron. The machine manufacturer was dubious about accepting the castings as he always had obtained high phosphorous in this iron.

This was based on the premise that the thin sections in the frame could not be cast without defect unless high-phosphorus iron was used. The new foundry demonstrated that the frame could be cast without difficulty from its regular iron, and then proceeded to show that the high-carbon, low-silicon iron had higher deflection properties.

The foundry did not have measuring equipment and sent the job to a commercial laboratory, where deflections were measured for both types of castings. The high-carbon, low-phosphorus iron showed higher deflection properties. Samples sent to the machine shop were found to machine better, and the frames could be more easily straightened after certain machining operations. It was also found that less breakage occurred. This coincided with the manufacturer's observation that frequent breakage occurred in shipment. Hence, the old source was changed over to low-phosphorus iron.

An attempt has been made to acquaint the foundryman with some of the services that may be obtained from commercial laboratories. Uniformity obtained through control enables a producer to sell a more attractive product. Customers welcome uniformity because it enables them to reduce machining changes and speed up such operations. It is suggested that foundrymen avail themselves of some of the services provided by laboratories in an attempt to decrease foundry costs and increase casting quality and yield.

ELECT NEW MFS OFFICERS AT ANNUAL MEETING

RALPH T. RYCROFT, Kencroft, Malleable Co., Inc., Buffalo, N.Y., was elected president of the Malleable Founders' Society at the organization's annual meeting June 22-23 in Hot Springs, Va. Named vice-president was Cal C. Chambers, Texas Foundries, Inc., Lufkin, Tex. Newly elected directors are W. V. Tiscornia, Auto Specialties Mfg. Co., St. Joseph, Mich.; Max Traum, Newark Malleable Iron Works, Newark, N.J.; C. M. Lewis, Badger Malleable & Mfg. Co., South Milwaukee, Wis.; and Mr. Chambers. New MFS President Rycroft, in announcing the society's program for the coming year said that emphasis will continue to be on a three-fold program: improvement in quality and production techniques; better cost accounting methods; and sales promotion. He said the society would sponsor another Market Development Conference early this fall.

R. T. Rycroft

At a session of the Board of Directors, Lowell D. Ryan was renamed managing director and secretary of MFS and James H. Lansing, entering his 15th year as technical and research director was again appointed to that position.

The 1950 McCrea Medal, awarded annually for outstanding service to the malleable castings industry, was presented at the society's annual banquet to Frank O. Parker, Dayton Malleable Iron Co., Dayton, Ohio. The award is made annually in memory of Charles H. McCrea, former president of National Malleable & Steel Castings Co., Cleveland.

In presenting the award Ralph N. Cole, Canton Malleable Iron Co., Canton, Ohio, reviewed Mr. Parker's career in the foundry industry which was launched when he became an inspector for the Malleable Founders' Society in 1923. He has worked in the industry in various executive capacities, principally sales, and was chairman of the MFS committee which had charge of production of the motion picture *"This Moving World."* He was president of the society in 1938 and 1939 and for many years served on the Board of Directors.

Retiring President James H. Smith, Central Foundry Div., General Motors Corp., Saginaw, Mich., reviewed the various projects and activities of the society noting especially the increased interest in improving safety records and the constructive effort put behind the program to increase the market for malleable. He pointed out that the goal of a million tons of malleable castings per year had not been attained but that it is a goal which can be reached.

Electric Metal Makers Guild Elects

ANNUAL JUNE MEETING of the Electrical Metal Makers Guild featured election of the following officers: president, D. L. Clark, superintendent of melting, Simonds Saw & Steel Co., Lockport, N. Y.; vice-president, C. C. Spencer, superintendent of melting, Electric Steel Casting Co., Indianapolis; and secretary-treasurer (re-elected), R. J. McCurdy, superintendent of melting, Republic Steel Corp., Chicago.

Meeting guest speakers were W. P. Dudley, Ohio Steel Foundry Co., Springfield, Ohio, and Poet-Philosopher Barton Rees Pogue of Upland, Ind.

New, Smaller A.F.S. Pins Available

Contrasted here in actual sizes are the old A.F.A. pin and the new, smaller A.F.S. pin, reduced in size by popular demand of members of the Society. The new ⅝ in. diameter pins will be traded for the old A.F.A. pins at no extra cost or are available at $1 each from A.F.S. National Office, 616 S. Michigan, Chicago 5.

NODULAR IRON—A BIBLIOGRAPHY

F. R. Morral
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Syracuse University
Syracuse, N. Y.

RAPID DEVELOPMENT OF THE LITERARURE of nodular iron in the few years since this unusual metallurgical development was announced makes the following bibliography—prepared by Prof. F. R. Morral, Syracuse University, with the assistance of L. Iannettoni, also of the Materials Engineering Dept.—helpful to foundrymen interested in studying production and properties of material. Prof. Morral's bibliography has been expanded greatly since he prepared it for the New York State Regional Foundry Conference held in Syracuse late last year. Illustrations show nodular graphite of various types as viewed through the microscope by natural and polarized light, and as seen in the electron microscope.

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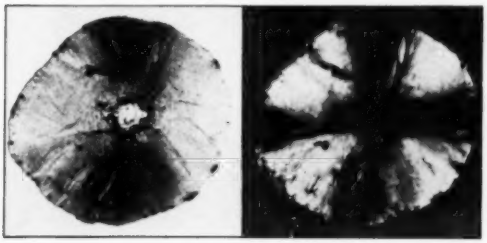

Graphite nodule (left) and the same nodule in polarized light (right). X1500 (reduced approx. 40 per cent in reproduction). J. E. Rehder, Canadian Bureau of Mines.

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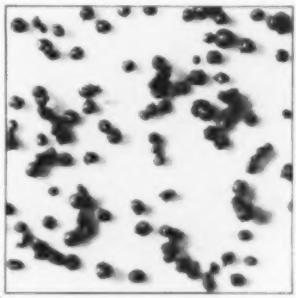

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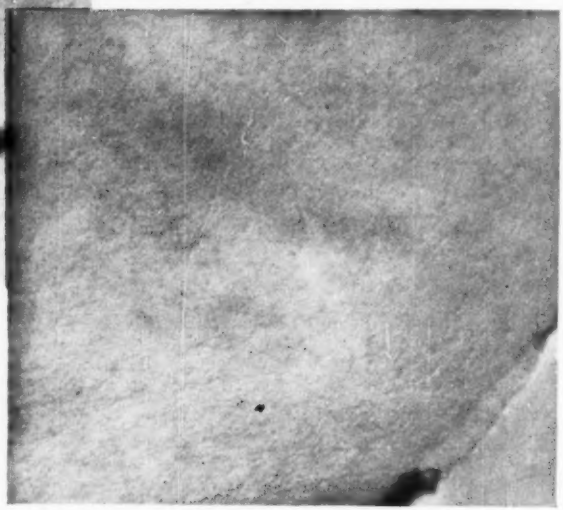
NODULE CENTER ⬇

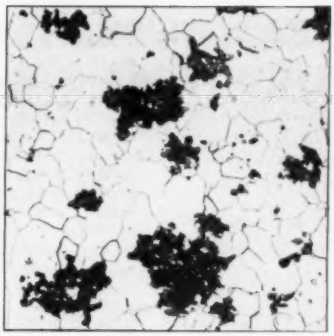
This electron micrograph, made during the investigation in which the composite micrograph was developed, represents what may be the central core of a graphite nodule. Magnification is of the order of X9000.

Electron micrographs made from a replica stripped from a sample of nodular iron, and believed to show the center to edge area of a graphite nodule. It is doubtful as to what is shown in the composite micrograph, but it is felt that part of the edge contour of the nodule is revealed. Magnification is of the order of X9400. The micrographs were made at Pennsylvania State College, State College, Pa., by Q. C. Soprano, graduate student in metallurgy, under the direction of R. W. Lindsay, associate professor of metallurgy, from nodular iron samples supplied by D. E. Krause, Gray Iron Research Institute, Columbus, Ohio.



EDGE OF NODULE ⬆

Spherulitic aggregate in magnesium-treated and inoculated hypo-eutectic iron. Unetched. X1500. H. Morrogh, British Cast Iron Resch. Assn.



"Graphite flake-aggregate temper carbon nodules" in a sample of blackheart malleable cast iron having sulphur present as MnS. Etched 2 per cent nital. X100 (H. Morrogh).

Almost perfect graphite spherulite obtained in magnesium-treated and inoculated hypo-eutectic iron. Unetched. X1500 diam. (H. Morrogh).

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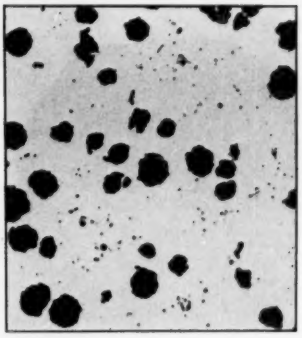

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R-104—J. E. Rehder, "Does Nodular Iron Resist Zinc?" AMERICAN FOUNDRYMAN, Jan. 1950, p. 62.

R-200—J. T. Tozsa, "Spectrographic Analysis of Ductile Cast Iron," *Iron Age*, Dec. 22, 1949, p. 73.

S-1—O. Smalley, "Some Notes on the History of Nodular Irons," *Iron Age*, May 19, 1949, p. 100.

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S-200—J. C. H. Stearns, "What's in a Name?" AMERICAN FOUNDRYMAN, 16, Nov., 1949, p. 46.

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T-100—A. Thum and H. Ude, "The Elasticity and Repeated Bending Strength of Cast Iron," *Die Giesserie*, 16, 1929, pp. 501-547.

V-1—G. Vennerholm, "Nodular Cast Iron, A Symposium," AMERICAN FOUNDRYMAN, 16, July, 1949, p. 37.

V-2—G. Vennerholm, "What's in a Name?" AMERICAN FOUNDRYMAN, 16, Oct., 1949, p. 35.

V-3—G.Vennerholm, H. Bogart, and R. Melmoth, "Nodular Cast Iron," *Foundry Trade Journal*, 88, Mar. 9, 1950, pp. 247-56.

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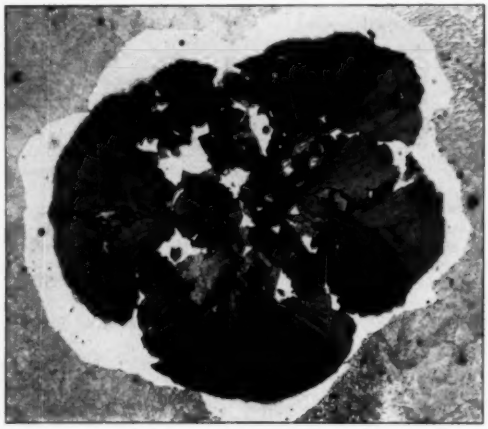
◀ *Graphite spherulites in a sample of high sulphur white-heart malleable iron. Unetched. X100. Micrograph, H. Morrogh.*

Spherulitic aggregate in cerium-treated and inoculated hyper-eutectic iron. Etched, 4 per cent picral. X500. (H. Morrogh.) ▶



STUDENTS LEARN ABOUT CASTINGS INDUSTRY THROUGH SOUTHERN CALIFORNIA ESSAY CONTEST

E. K. Smith, Chairman
Educational Committee
Southern California Chapter

THE PRIZE ESSAY CONTEST of the Southern California Chapter, carried on under the direction of the Educational Committee aroused great interest among students and educators, and was enthusiastically received by the foundrymen of the area. Objects of the contest were to interest young men of the junior colleges in foundries as good places to work, and to show future designers and engineers that castings can be used to great advantage.

The contest started with trips through foundries for some 650 students representing 16 colleges who were to write essays on anything related to the foundry industry or its products that interested them. The 50 essays submitted from students of 12 of the colleges were judged by members of the Educational Committee and on May 19 the winners and their instructors were guests of the Southern California Chapter at its meeting. Prizes awarded were $50, $35, $25, $20, and eight of $10 each for the best essay from each of the competing colleges not represented in the top four.

The contest was first discussed by the Educational Committee with state, county, and city Boards of Education, all of which gave hearty approval. It was decided to restrict the contest to junior colleges and trade schools, many of whose students go directly into industry. The Boards compiled a list of colleges complete with names of men to contact.

Preparatory to arranging visits for groups of students to the various foundries of the area, two or three calls were made at each college to see the appropriate men and to arouse their interest in the contest. In some cities it was necessary to obtain a written permit before the contest could be started in the schools.

The students were enthusiastic about the contest, and accompanied by their instructors, they were conducted all around the foundry while it was in operation. Guides were foundrymen qualified to answer a multitude of questions. Back at school, the students were given the opportunity to write a brief composition on their impressions of the foundry. They were encouraged to write on anything they saw, or thought, or were told.

While only about one-twelfth of the students who visited the foundries entered a paper, most of the colleges expressed the desire to enter further such competitions. Directors of the Southern California Chapter have decided to continue the contest during the coming year.

Typical reaction of educators is this letter from El Camino College:

"In behalf of the college, I would like to say that we were very pleased to have one of our students the recipient of one of your essay prizes. We in the education business are always anxious to cooperate with an organization such as yours for we know that you have always been staunch supporters of free public education. We also know that you are concerned with the welfare and training of the youth of this nation.

"From my observation the instructors and the students both enjoyed the field trips through the foundries. I have heard many favorable comments from them, and I am sure that such trips will become a part of our instruction in future years. In closing, may I express our appreciation for being invited to participate in this contest. Please feel free to visit our institution and facilities at any time, and to call on me for assistance in matters similar to this one."

Members of the Chapter Educational Committee in addition to Chairman Smith, are National Director Robert Gregg, Reliance Regulator Div., American Meter Co., Alhambra; L. M. Nash, Magnesium Alloy Products Co., Compton; and the following, all of Los Angeles: E. F. Green, Axelson Mfg. Co.; W. D. Emmert, Los Angeles Steel Castings Co.; John W. Janca, Westlectric Castings, Inc.; Robert R. Haley, Advance Aluminum & Brass Co.; and Prof. J. R. Cady, University of Southern California.

Upper—Some of the 50 students who submitted essays on their impressions of a foundry photographed with their instructors. Shown is the only woman contestant to win a prize. Lower—Students and instructor from Glendale College during visit to foundry of Axelson Mfg. Co., Los Angeles, on one of the foundry inspections on which contest papers and essays were based.

COLORIMETRIC DETERMINATION OF NICKEL IN MONEL METAL

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NICKEL is usually determined in monel metal by electrodeposition[1]. However, the procedure is lengthy for routine work and a more rapid substitute method has been sought. In view of the demonstrations by Mehlig and co-workers[2-3] that colorimetric determinations are often not limited to micro quantities of constituents, the applicability of the dimethylglyoxime colorimetric method for nickel[4] over the range of nickel usually present in monel metal has been tested and found sufficiently accurate for control work.

Apparatus and Reagents

Electrophotometer and 23-ml cells.
Microburette, 1 ml.
Citric acid solution—dissolve 10 gm c.p. citric acid in 100 ml distilled water.
Ammonium hydroxide—c.p. ammonium hydroxide (1:1).
Nitric acid—c.p. nitric acid (1:1).
Iodine solution—25.0 gm of potassium iodide dissolved in 50 ml distilled water; 13.0 gm c.p. iodine added and the solution diluted with distilled water to 1 liter.
Dimethylglyoxime solution—dissolve 1.0 gm dimethylglyoxime in 100 ml ethanol.

Procedure

Dissolve a 0.4-gm sample with nitric acid, add perchloric acid and take to strong, white fumes. Dilute, filter off silica, add 10 ml c.p. nitric acid (1:1) and electrolyze for copper. After electrolysis dilute the solution to exactly 1,000 ml and mix thoroughly. Using a microburette transfer 0.5 ml of the solution to a 100 ml volumetric flask and add, with swirling after each addition, 1 ml of c.p. nitric acid (1:1), 10 ml of citric acid solution, 1 ml of iodine solution, and 10 ml of ammonium hydroxide. Add 1 ml dimethylglyoxime solution and dilute to the mark. Mix well and after 20 min read on the colorimeter at 525 millimicrons. Refer the scale reading to a curve made up by carrying known quantities of c.p. nickel through the same procedure.

The reproducibility of the method and accuracy to be expected are shown in Table 1. The results are surprisingly good, considering the high dilution factor. Colored ions—copper, chromium, cobalt, iron, etc.—interfere by adding to the nickel color, but copper has been removed electrolytically and chromium is not usually present. Iron up to 50.0 mg does not interfere.

TABLE 1—REPRODUCIBILITY OF COLORIMETRIC DETERMINATIONS OF NICKEL IN MONEL METAL

Sample	Ni Present	Ni Found
B. S. 162[a]	66.38[b]	66.53[c]
Cast monel	65.66[d]	65.60
Cast monel	67.70[d]	67.80
"K" monel	65.20[d]	65.35
"S" monel	64.63[d]	64.75

[a] Composition of alloy: Cu, 28.93; Mn, 2.31; Si, 0.67; Co, 0.54; Fe, 0.34; Cr, 0.24; Al, 0.23; Ti, 0.20 per cent.
[b] National Bureau of Standards certified value.
[c] Mn removed as MnO_2 (average of 7 determinations ranging from 66.50 to 66.60).
[d] Determined electrolytically.

The color of the cobalt ion is weak, 0.1 mg of cobalt corresponding to about 0.0015 mg nickel.

Manganese, if present above 2 per cent, seriously interferes because of the formation of brown, colloidal peroxide. If present above that concentration manganese is best removed as MnO_2 by potassium chlorate in nitric acid solution, prior to the perchloric acid treatment for silica. Fortunately, manganese is seldom present in monel metal samples above 1.50 per cent.

The author wishes to acknowledge the assistance of I. Gordon during the course of this work.

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Future Meetings and Exhibits

NATIONAL ASSOCIATION OF FOREMEN, annual meeting, Hotel Statler, Buffalo, N. Y.—Sept. 13-18.

INSTRUMENT SOCIETY OF AMERICA, fifth national instrument exhibit, Memorial Auditorium, Buffalo, N. Y.—Sept. 18-22.

STEEL FOUNDERS' SOCIETY, annual fall meeting, The Homestead, Hot Springs, Va.—Sept. 25-26.

ASSOCIATION OF IRON AND STEEL ENGINEERS, annual convention and exposition, Cleveland Public Auditorium, Cleveland—Sept. 26-29.

ALL-CANADIAN FOUNDRY CONFERENCE, sponsored by A.F.S. Eastern Canada and Ontario Chapters, Hamilton, Ontario—Sept. 28-30.

TEXAS REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Texas Chapter, Plaza Hotel, San Antonio, Texas—Oct. 5-6.

GRAY IRON FOUNDERS' SOCIETY, annual meeting, Netherland Plaza Hotel, Cincinnati—Oct. 12-13.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, annual meeting, The Greenbrier, White Sulphur Springs, West Virginia—Oct. 12-14.

NON-FERROUS FOUNDERS' SOCIETY, annual meeting, Hotel Statler, Boston—Oct. 13-15.

AMERICAN SOCIETY FOR METALS, national metal exposition and Congress, International Amphitheater, Chicago—Oct. 23-27.

METALS CASTING CONFERENCE, A.F.S. Central Indiana and Michiana Chapters and Purdue University, at Purdue, West Lafayette, Ind.—Nov. 2-3.

STEEL FOUNDERS' SOCIETY, annual technical and operating conference, Carter Hotel, Cleveland—Nov. 9-11.

MICHIGAN REGIONAL FOUNDRY CONFERENCE, A.F.S. Detroit, Central Michigan, Saginaw Valley, and Western Michigan Chapters, Michigan State College Student Chapter, and Michigan State College, at East Lansing, Mich.—Nov. 10-11.

BIRMINGHAM REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Birmingham District Chapter, Tutwiler Hotel, Birmingham, Ala.—Feb. 22-23, 1951.

55th Annual Foundry Congress, American Foundrymen's Society, Buffalo, N. Y.—Apr. 23-26, 1951.

WHO'S WHO

F. R. Morrall

F. R. Morral, author of *"Nodular Iron—A Bibliography,"* Page 61, was educated in the United States, Sweden and Spain and has authored more than 50 papers on metallurgy for publication in those countries . . . Associated with research and technical developments in metallurgy with industrial organizations and educational institutions, Dr. Morral has taught metallurgy at Pennsylvania State College, the University of Barcelona in Spain and in several vocational schools . . . He is at present associate professor of Materials Engineering at Syracuse University, Syracuse, N. Y.

B. P. Mulcahy

B. P. Mulcahy, author of *"Burning-In the Cupola Bed,"* Page 42, is president of Fuel Research Laboratories, Inc., Indianapolis . . . A recognized authority on cupola fuels and operation, Mr. Mulcahy is prominent in technical committee work of A.F.S., ASTM, American Coke & Coal Chemicals Institute and the American Gas Association . . . A graduate of the University of Illinois, he was for many years prominent in research work for gas and coke utilities and as a consultant on cupola operation and coal carbonization . . . Mr. Mulcahy has frequently addressed A.F.S. meetings on this subject.

E. D. Boyle

Edward D. Boyle, author of *"Mineral Perlite — Foundry Uses,"* Page 25, is master molder at the Puget Sound Naval Shipyard, Bremerton, Wash., where his outstanding work in solving difficult molding problems and in developing new techniques materially aided the war effort and earned him a Naval citation for meritorious service . . . Active in A.F.S., Mr. Boyle was instrumental in organizing the Washington Chapter and has served as its chairman.

H. R. Isenburger

H. R. Isenburger, author of *"Apply Radioisotope — Cobalt 60—To Radiography of Castings,"* Page 48, is a native of Germany, where he attended Berlin Technical University . . . Coming to the United States in 1925, he studied metallurgy, physics and chemistry nights, becoming a citizen in 1932 . . . Joining St. John X-Ray Service, Inc., in 1927 he was made vice-president in 1928 and president in 1933 . . . He today heads that organization's offshoot, the St. John X-Ray Laboratory, Califon, N. J., and speaks frequently before university and technical society groups on metals radiography.

E. W. Horlebein

Edwin W. Horlebein, whose Annual Address as President of the American Foundrymen's Society appears on Page 28, scarcely requires an introduction to members of the Society . . . He is a Past National Director of the Society (1945-48) and Past National Vice-President (1948-49), organized and served as first chairman of the Chesapeake Chapter, and has been active in the A.F.S. Brass & Bronze Division . . . President of Gibson & Kirk Co., Baltimore, Mr. Horlebein was prominent in war work, serving as chairman of the OPA Brass & Bronze Advisory Committee, and is a member of the Munitions Board Committees on Copper and Copper Base Alloys and Foundry Advisory Committee . . . He was recently elected president of the National Castings Council at its meeting during the 1950 A.F.S. Convention.

Hiram Brown

Hiram Brown, whose article on *"Precision Aluminum Castings"* appears on Page 50, is vice-chairman of the A.F.S. Aluminum & Magnesium Division, whose Program & Papers Committee and Sand Castings Committee he heads . . . Graduated cum laude from Penn College, Cleveland, he served, successively, as foundry metallurgist for Aluminum Co. of America, chief metallurgist for Frontier Bronze Corp., Niagara Falls, N. Y., assistant works manager of Aluminum Industries, Inc., Cincinnati, and is today chief metallurgist for Solar Aircraft Corp., Des Moines . . . Author of *Aluminum and Its Applications*, published in 1918, he has written some 28 articles on aluminum casting and metallurgy for the trade and technical press.

H. H. Harris

H. H. Harris, whose recent contributions to the development of casting processes for national defense are described in *"Modern Foundry Methods,"* Page 34, is president and founder of General Alloys Co., Boston . . . Mr. Harris' varied and colorful career has included service with the Air Corps in World War I, studies with Dr. Albert Sauveur of Harvard in metallurgy and with Prof. John Eeller of the Illinois Institute of Technology on heat treating . . . Sales manager of Swedish Crucible Steel Co., Detroit, at the age of 19, Mr. Harris formed General Alloys Co. that same year, and was concurrently a partner in the engineering firm of Noble and Harris and consultant on stainless steel to U. S. Steel Corp. . . . Following wartime service on several committees and as director of a non-profit contract for development of jet-engine alloy components for the Air Force, Mr. Harris has been director of a Navy research and development program using facilities of General Alloys Co. and Alloy Engineering & Casting Co., Champaign, Ill. . . . He is today directing a program of further casting development for the Armed Forces, correlated with development and pilot production work for several leading industries.

SFSA Sponsors Foundry Safety Contest

NATIONAL COMPETITION, open to its member foundries, is being conducted by the Steel Founders' Society of America during June, July and August to determine the participating foundries with the lowest lost-time accident rates for the period.

Awards will be based on statistical results of monthly reports filed with the Society under rules formulated by its Safety Committee.

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Claud S. Gordon Co., Chicago, Ill.—Vincent Manka, Vice Pres.—(Chicago Chapter).

Griffith-Raguse & Co., Inc., Philadelphia, Pa.—W. J. Griffith, Pres. (Philadelphia Chapter)—Conversion from Personal.

Magie Bros., Inc., Chicago, Ill.—S. W. Bodman, Jr., Sales Mgr., (Chicago Chapter).

Missouri Steel Castings Co., Joplin, Mo.—Philip V. Spooner, Pres. (Tri-State Chapter).

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Otto J. Brechtelsbauer, Ventilation Engr., Chevrolet Grey Iron Foundry, G.M.C., Saginaw, Mich.
Warren E. Brown, Student, General Motors Institute, Flint, Mich.
Herbert S. Busch, Fmn., Chevrolet Grey Iron Foundry, G.M.C., Saginaw, Mich.
David L. De Graff, Student, General Motors Institute, Saginaw, Mich.
Leo E. De Lories, Power Engr., Chevrolet Grey Iron Foundry, G.M.C., Saginaw, Mich.
William E. Douglas, Student, General Motors Institute, Flint, Mich.
Ralph F. Evert, Methods Supv., Eaton Manufacturing Co., Fdy. Div., Saginaw, Mich.
George B. Ford, Purch. Agent, Chevrolet Grey Iron Foundry, G.M.C., Saginaw, Mich.
Gordon Gode, Supv., Saginaw Malleable Iron Plant, Central Foundry Div., G.M.C., Saginaw, Mich.
Milton R. Heidt, Student, General Motors Institute, Flint, Mich.
Joseph A. Krawczak, Fmn. Chevrolet Grey Iron Foundry, G.M.C., Saginaw, Mich.
Serge Miller, Mgr., Brisk Foundry & Machine Co., Imlay City, Mich.
William G. Mixer, Consultant, General Motors Corp., (Retired), Flint, Mich.
Bruce F. Nelson, College Grad in Training, Chevrolet Grey Iron Foundry, Saginaw, Mich.
Clarence Qualman, Div. Supt., Chevrolet Grey Iron Foundry, G.M.C., Saginaw, Mich.
Merle C. Railing, Supervision, Engrg. Dept., Saginaw Malleable Iron Plant, Central Foundry Div., G.M.C., Saginaw, Mich.
E. L. Richmond, Supv., Saginaw Malleable Iron Plant, Central Foundry Div., G.M.C., Saginaw, Mich.
Lawrence A. Spavth, Design Engr., Saginaw Malleable Iron Plant, Central Foundry Div., G.M.C., Saginaw, Mich.
James H. Wehan, Salesman, Corn Products Sales Co., Detroit.
Carl F. Wood, Ventilation Engr., Chevrolet Grey Iron Foundry, G.M.C., Saginaw, Mich.

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Frank X. Hohn, Asst. Works Mgr. & Chief Met., Scullin Steel Co., St. Louis, Mo.
Harold Smith, Chief Insp., Key Company, E. St. Louis, Ill.

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James B. Chamberlain, Met., Aluminum Co. of America, Los Angeles.
Henry E. Francis, Partner, Non-Ferrous Alloys Foundry, Los Angeles.
Silas R. Kimberly, Supt. & Met., Centrifugal Castings Co., Long Beach, Calif.
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John C. Rau, Salesman, Musto-Keenan Co., Los Angeles.
H. M. Rutledge, Sales Engr., National Carbon Co., Los Angeles.
Richard V. Sloan, Dist. Repr., American Air Filter Co., Los Angeles.

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Ralph M. Miller, Melter, Ross Meehan Foundries, Chattanooga, Tenn.

TEXAS CHAPTER

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TOLEDO CHAPTER

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TRI-STATE CHAPTER

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Stanley T. Majeski, Gen. Fmn., Lakey Foundry & Machine Co., Muskegon, Mich.
Maxwell Ryefield, Fmn., Sealed Power Corp., Muskegon, Mich.
Ernie Vick, Sales Mgr., Ajax Metal Co., Detroit.

WESTERN NEW YORK CHAPTER

Henry L. Wiard, Vice Pres., Wiard Plow Co., Batavia, N. Y.

WISCONSIN CHAPTER

D. S. Bosma, Supt. of Foundries, Bucyrus Erie Co., Milwaukee.
Fred C. Broderick, Billing Dept. Supv., Grede Foundries, Inc., Milwaukee.
James E. Burke, Vice Pres., Wisconsin Grey Iron Foundry Co, Milwaukee.
John T. Jarman, Gen. Supt., Chem. & Met. Labs., Allis-Chalmers Mfg. Co., Milwaukee.
Louis Mueller, Wisconsin Grey Iron Foundry Co., Milwaukee.
Steve F. Vencel, Gen. Fmn., Standard Foundry Co., Milwaukee.
Carl Max Wolff, Graduate Training Student, Allis-Chalmers Mfg. Co., Milwaukee.
Richard Theodore Voelz, Student, University of Wisconsin, Milwaukee.

STUDENT CHAPTERS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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MICHIGAN STATE COLLEGE

Leslie Lee Lamport

MISSOURI SCHOOL OF MINES

Edward W. Cawthorne Melvin C. Hockenbury
Edwin Elliott, Jr. Robert E. Schubardt

UNIVERSITY OF ILLINOIS

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Hernando Gomez John C. Logan

UNIVERSITY OF MINNESOTA

Patrick A. Calvin Charles M. Moreaux
Dean R. Kempf Warren F. Wade

OUTSIDE OF CHAPTER

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B. F. Brown, Rsch. Assoc., MIT, Cambridge, Mass.
Sem S. Brubaker, Jr., Fdy. Supt., Steel Heddle Mfg. Co., Greenville, S. C.
Frank H. Goodwin Prop., Goodwin Bradley Pattern Co., Providence, R. I.
Milton E. Hobbs, Instr. Ind. Engr., North Carolina State College, Raleigh, N. C.
Laurence J. Litalien, Met. Engr., Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.
Charles W. Maddison, Fdy. Instr., North Carolina State College, Raleigh, N. C.
Warren B. Zepp, Asst. Prof. of Mech. Engr., Worcester Polytechnic Institute, Worcester, Mass.

Australia

W. F. Hasemer, Joint Managing Dir., Hasemer Bros. Pty. Ltd., Marrickville, N.S.W., Australia.

England

Messrs. T. M. Birkett & Son, Ltd., Stoke on Trent, Staffs., England.
Hugh Prentice Hughes, Fdy. Cons., British Electro-Metallurgical Co., Sheffield, England.

France

Bureau D'Etudes & De Documentation Industrielle, Paris, France.

Italy

Felice Boella, Engr., Fiat Grandi Motori, Ufficio Biblioteca, Torino, Italy.
Ansaldo S.P.A. Stab. Fonderie de Ghisa e Metalli, Genova-Pegli, Italy (Noris Mario, V. Direttore).
Allen G. Van Wye, Met., Finmeccanica, Rome, Italy.

South America—(Argentina)

Biblioteca Cristalerias Rigolleau S. A., Berazategui, F.C.N.G.R., Buenos Aires, Argentina.
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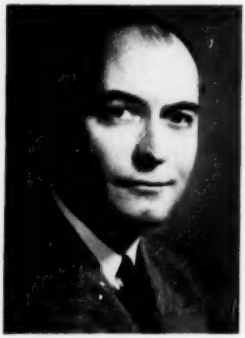
Carlos F. Zampieri, Cristalerias Rigolleau S. A., Buenos Aires, Argentina.

Switzerland

Walter Goetz, Fdy. Engr., George Fischer Ltd., Schaffhausen, Switzerland.

FOUNDRY Personalities

A. S. Johnson has been named general manager of the National Carbon Division of Union Carbide & Carbon Corp. Mr. Johnson, who joined the organization's Edgewater Plant, Cleveland, in 1928, was sent to China in 1933 to assist in plant operations in that country, returning to the United States in 1939 as assistant superintendent of the Fostoria, Ohio, plant. In 1942, he was named superintendent of the Clarksburg, W. Va., plant and later that year was appointed Cleveland District manager. In 1944 Mr. Johnson became assistant to the vice-president in charge of production and in 1945 was assigned to the Foreign Department. He has been a vice-president since 1948.



A. S. Johnson

Harold S. Austin, foundry metallurgist, Buick Motor Div., General Motors Corp., Flint, Mich., retired as of June 30. Mr. Austin, a graduate of Rose Polytechnic Institute, was with Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., for 17 years, prior to joining Buick in 1938.

Raymond M. Thayer has been named superintendent of the United States Graphite Co.'s Saginaw, Mich., plant, succeeding the late Albert J. Lent. Mr. Thayer has 24 years' service with the company, having joined U. S. Graphite shortly after his graduation from Michigan State College in 1926. Since 1942 he has been chief inspector for the company.

William T. Bean, Jr., has been named director of Industrial Electronics, Inc.'s new Technical Service Center, an organization which will combine Mr. Bean's work in stress analysis with the services of Industrial Electronics, Inc. Mr. Bean has been a frequent speaker before A.F.S. meetings on stress analysis.

Werner G. Smith recently resigned as executive vice-president of Archer-Daniels-Midland Co. and has announced his re-entry into the core oil manufacturing business by the formation of an entirely new and independent firm, Werner G. Smith, Inc. Mr. Smith was founder and managing head of the Werner G. Smith Division of the Archer-Daniels-Midland Co. Already in operation, Mr. Smith's new company is specializing in manufacture and sale of foundry core oils. General offices are at 228 Union Commerce Bldg., Cleveland, and sales offices will shortly be opened in principal U. S. cities.

Werner G. Smith

James H. Rickey, Jr., has been named sales manager of the Ironton Fire Brick Co., Ironton, Ohio. Holder of a degree in ceramic engineering from Ohio State University, Mr. Rickey served overseas as a Captain of Engineers in World War II prior to joining Ironton's Production department three years ago.

Julian N. Phelps, formerly foundry metallurgist for Vanadium Corp. of America, Detroit, has joined Kerchner, Marshall & Co., Pittsburgh, as a sales engineer. A graduate in chemical engineering from the University of Pittsburgh, he served, successively, as pit foreman for American Steel & Wire Co., Donora, Pa.; melter for Mackintosh-Hemphill Co., Midland, Pa.; and with Vanadium Corp. of America both at Niagara Falls, N. Y., and Detroit. He has served as secretary of the A.F.S. Detroit Chapter since 1948.

Joseph A. Blizman, for seven years supervisor of production, has been appointed sales and service engineer for the Herman Pneumatic Machine Co., Pittsburgh. Mr. Blizman, who has been with the company for 20 years, will have as his sales and service territory Ohio, West Virginia, Western New York, Western Pennsylvania and Central Canada.

Henry C. Winte of Wauwatosa, Wis., has been appointed superintendent of the Stoughton, Wis., plant of the Garden City Foundry Co., Chicago.

George P. Antonic, formerly engaged in ferrous foundry research with Walter Gerlinger, Inc., Milwaukee, has been named superintendent of Plant 1 of Motor Castings Co., West Allis, Wis., for whom he worked before joining Gerlinger.

G. P. Antonic

Members of the Standards Council of the American Standards Association who were recently awarded honorary certificates for work in the development of industrial standards are: **J. D. Capron,** president, Glamorgan Pipe & Foundry Co., Lynchburg, Va., representing the Cast Iron Research Association; and **John Hellstrom,** vice-president, American Air Filter Co., Louisville, representing the Foundry Equipment Manufacturers Association.

John M. Urban, foundry superintendent and metallurgist, Fanner Mfg. Co., since 1939, has been appointed technical service representative in the Coke Sales Dept. of Diamond Alkali Co. In his new capacity Mr. Urban will contact foundries in Northern Ohio, Western Pennsylvania, Western New York and Southeastern Michigan. He is a director of the A.F.S. Northeastern Ohio Chapter.

Newly-appointed manager of the Eclipse-Pioneer Division foundry, Bendix Aviation Corp., Teterboro, N. J., is **Robert E. Ward,** formerly director of metallurgy for the Division. **Ralph D. Ferguson,** formerly assistant foundry manager, has been named

Division foundry sales manager. Mr. Ward was formerly head of the A.F.S. Aluminum Division and has been active on several committees in that Division.

Prominent overseas visitors to A.F.S. National Office, Chicago, during the later part of May and in June included **Francisco Mira,** general manager, Fundicion ,Mira, Cordoba, Argentina, in this country to study foundry techniques; **William A. Gibson,** Gibson Engineering Sales, Pty., Ltd., Sydney, Australia, official A.F.S. representative "down under" and a frequent visitor to the United States; and **Rolf Landmark** of the Norwegian attache's office, Washington, who accompanied the Norwegian Foundry Productivity Team on its inspection tour of U. S. foundries and at the 1950 A.F.S. Foundry Congress & Show in Cleveland, May 8-12.

OBITUARIES

George W. Pressell, 62, vice-president of E. F. Houghton & Co., Philadelphia, died June 5 at his summer home in Ocean City, N. J. Oldest Houghton employee in point of service, Mr. Pressell started as a $2-a-week messenger boy some 42 years ago. During this period he was, successively, chief chemist, secretary, second vice-president, general sales manager and director of sales. He had been a member of the Board of Directors since 1919.

William E. Paulson, president of Thomas Paulson & Son, Inc., Brooklyn, N. Y., nonferrous foundry and engineering firm, died May 31 at his home in Plandone, Long Island, N. Y. Holder of a mechanical engineer degree from Stevens Institute of Technology in 1901, Mr. Paulson held engineering positions with Westinghouse Electric Corp. and Consolidated Gas Co. of New York, and assisted in construction of the Pennsylvania Railroad tunnel into the Pennsylvania Station in New York City. In 1910 he joined Thomas Paulson & Son, Inc., organized by his father in 1883, and in 1928, upon his father's death, succeeded him to the presidency of the concern. Instrumental in organizing the Metropolitan Brass Founders Association in 1911, Mr. Paulson served several terms as its president. A past chapter director of the American Foundrymen's Society, Mr. Paulson was a director of the Non-Ferrous Founders' Society at the time of his death.

Wilbur W. Thawley, president of Non-Ferrous Foundry, Inc., Philadelphia, died in his office June 5. A member of A.F.S. and instrumental in forming the Philadelphia chapter of the Non-Ferrous Founders' Society, he was also sales representative for Empire Steel Castings, Inc., Reading, Pa., and Carver Foundry, Inc., Philadelphia, at the time of his death. He started his industrial career as an expediter and layout man with Philadelphia Bronze & Brass Co. In 1929 he became associated with Philadelphia Non-Ferrous Foundry, Inc., which later became the company Thawley headed until his death.

Robert B. Dickson, president of Kewanee Boiler Corp., Kewanee, Ill., died at his home April 9.

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UNIVERSITY OF ALABAMA

Advertisement

ELECTROMET *Data Sheet*

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

VANADIUM...the metal that accentuates the effects of other alloying elements

Vanadium is usually added to steel or iron along with other alloying metals, such as manganese, tungsten, nickel, or chromium. It enhances the effect of these other alloys and helps to improve the physical properties of the metal. Generally it is used in quantities of less than 0.50 per cent, but even in these small amounts it is responsible for many marked improvements in the quality of iron and steel.

One of the most notable functions of vanadium is its effect in improving the dynamic properties of steel, such as fatigue and impact resistance. It also gives an inherently fine grain size to both steel and iron.

In high-speed tools, vanadium contributes wear resistance and red hardness. It is also an important alloy in many types of permanent magnet steels. These and many other types of special-purpose steels contain more than 0.50 per cent vanadium to enhance certain properties.

Dynamic Strength for Steels

The principal effect of vanadium in engineering steels is that of refining grain size. It is usually added in amounts of 0.10 to 0.25 per cent.

Fig. 1. Steels in which vanadium is an alloy have outstanding dynamic strength. That is why they are frequently used in such heavy-duty service as springs and axles in diesel locomotive trucks.

In the lower carbon ranges, vanadium steels are especially suited for carburizing and are used for such applications as hand tools, bearings, and pistons. Vanadium-bearing steels can also be nitrided effectively.

Vanadium contributes fatigue and impact resistance and also strength and ductility to spring steels. The famous chromium-vanadium (SAE 6100 series) and manganese-vanadium spring steels are outstanding examples of this use. Besides being used as springs, these steels are frequently used for axles, shafts, and other highly stressed moving engine parts.

Red Hardness in Tools

Practically all fine tool steels contain vanadium. In high-speed steels, vanadium content usually ranges from about 0.50 to 2.50 per cent, although higher percentages are sometimes used. Other alloy tool steels usually contain from 0.20 to 1.00 per cent vanadium.

Vanadium is a strong carbide-former and forms very hard and stable carbides. These vanadium-carbides are probably the main reason for the excellent wear resistance and edge-holding properties of vanadium tool steels. The persistence of the vanadium-carbides is largely responsible for the cutting qualities at red hardness of high-speed tool steels.

Adds Strength to Cast Iron

In amounts of 0.10 to 0.15 per cent, vanadium increases the strength of cast iron from 10 to 25 per cent, and adds a considerable amount of toughness. Cast iron containing vanadium is especially valuable in such applications as steam locomotive cylinders, valve and piston bushings, piston rings, and similar parts. In steam engines and diesel motors, vanadium cast iron cylinders greatly outlast those of ordinary cast iron. Chromium-vanadium cast iron rolls, containing up to 2 per cent chromium, have been used successfully in steel mills for a great many years.

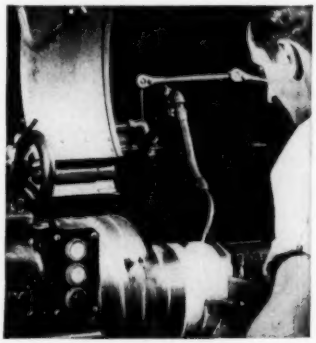

Fig. 2. Nearly all fine tool steels contain vanadium. It promotes fine grain size, high wear resistance, and greater control of hardenability. Vanadium also contributes to the red hardness of high-speed tool steels.

Cast iron in which vanadium is the sole alloying element is used primarily in applications where temperatures are moderately high and in heavy sections requiring uniform hardness without brittleness.

ELECTROMET Vanadium Alloys

ELECTROMET produces three grades of ferrovanadium in various sizes for the production of vanadium-bearing steels and irons. Each grade has a definite range of carbon and silicon contents and is especially adapted to assure the best results in the different requirements of iron and steelmaking.

Write for a copy of the booklet, "ELECTROMET Ferro-Alloys and Metals." It contains many useful facts about the use of ferrovanadium. The booklet also describes over 50 other alloys and alloying metals produced by ELECTROMET.

The term "Electromet" is a registered trademark of Union Carbide and Carbon Corporation.

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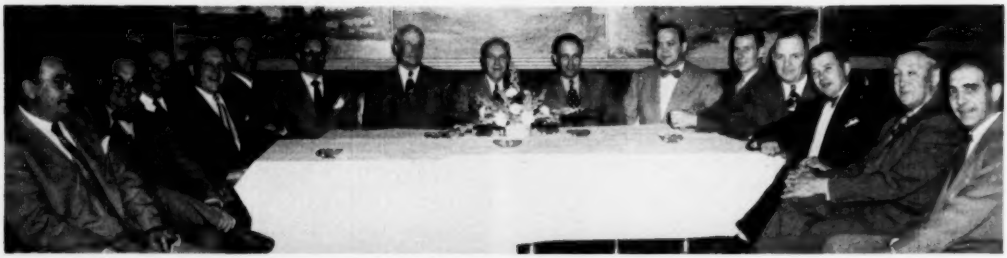

Attending a dinner party given in honor of E. W. Beach, who retired last May after many years' service with Campbell, Wyant & Cannon Foundry Co., were these prominent members of the A.F.S. Western Michigan Chapter. Left to right: Carl Trappe, William Holt, George Richardson, Gerritt Will, William Cannon, L. D. Ramsey, George W. Cannon, Mr. Beach, Stanley Davis, Ross Shaffer, Fred DeHudy, Webb Hallberg, C. N. Jacobson, Lee Taylor and Adrian Archambault. Mr. Beach will reside on Nantucket Is., Mass.

CHAPTER ACTIVITIES NEWS

Central New York

John A. Feola
Crouse-Hinds Co.
Publicity Chairman

MAY 19 MEETING, postponed one week so as not to conflict with the 1950 A.F.S. Foundry Congress & Show, May 8-12, featured as its speaker the late R. G. McElwee, Vanadium Corp. of America, Detroit, head of the A.F.S. Gray Iron Division. Mr. McElwee died June 21 while on a business trip to Vanadium Corp.'s plant at Niagara Falls, N.Y.

Mr. McElwee discussed work being done by the A.F.S. Cupola Research Committee, especially in slag control, and showed slides of charts and graphs plotted from results of experiments.

The speaker also cited work being done by European foundrymen in connection with cupola operations. U. S. foundrymen, he said, have done very little to improve the cupola recently.

Mr. McElwee added that with research and experimentation more can be learned as to what actually happens during melting operations. As a result of this research, he said, and its application to established procedures a more stable and efficient product can be obtained. The speaker concluded with a discussion of recent developments in nodular iron.

Chapter Chairman J. F. Livingston, Crouse-Hinds Co., presided at the business meeting and described briefly the foundry course to be established at Syracuse University for the benefit of engineering students, enabling them to obtain actual foundry experience and knowledge of the problems encountered in producing sound, clean castings for industry.

On behalf of the chapter, Chairman Livingston presented a check to Dr. F. R. Morrall, representing the Engineering College of the University, to aid in the purchase of necessary equipment. He also offered the services of members in laying out the foundry and in solving any problems that may arise. Several chapter members had previously checked a list of equipment and materials needed to establish the proposed foundry course.

Central New York Chapter Chairman J. F. Livingston, left, Crouse-Hinds Co., presenting Chapter's check for purchase of new equipment for proposed Syracuse University Foundry Course to Prof. F. R. Morrall, Engineering Dept.

Unanimously elected was the following slate of 1950-51 officers and directors of the chapter:

Chairman, David Dudgeon, Jr., Utica Radiator Corp.; *vice-chairman*, William D. Dunn, Oberdorfer Foundries, Inc.; secretary, D. J. Merwin, Oriskany Malleable Iron Co.; and treasurer, J. F. Dobbs, New York Air Brake Co.

Directors (terms expire 1953): Bruce Artz, Pangborn Corp.; John F. Livingston, Crouse-Hinds Co.; and George Hochsegang, Straight Line Foundry & Machine Corp.

Southern California

W. G. Stenberg
U. S. Electrical Motors, Inc.
Publicity Chairman

MAY 9 MEETING, held at the Rodger Young Auditorium, Los Angeles, had as its guests James A. Dickson, chairman of the British Columbia Chapter and 22 students, entrants in the chapter's Essay Contest.

Evening's speaker was C. V. Nass, Pettibone Mulliken Corp., Chicago,

D. E. Krause, executive director, Gray Iron Research Institute, speaking on "Ferrous Metallurgy for the Non-Metallurgist" at the May meeting of Central Ohio Chapter. (Photograph courtesy of Wilfrid H. White, Jackson Iron & Steel Co.)

FUTURE CHAPTER MEETINGS

● ***JULY 22***
TOLEDO
Bark Inn, 24 miles east of Toledo
ANNUAL PICNIC

● ***JULY 31***
TWIN CITY
Midland Hills Country Club, St. Paul
ANNUAL GOLF TOURNAMENT AND DINNER

● ***AUGUST 12***
CHICAGO
Lincolnshire Country Club
ANNUAL PICNIC

● ***AUGUST 19***
WESTERN MICHIGAN
Pontaluna Golf Club, Muskegon
ANNUAL STAG PICNIC

● ***SEPTEMBER 16***
NORTHWESTERN PENNSYLVANIA
Tieman's Grove and Lake Shore Golf Club, Erie, Pa.
ANNUAL PICNIC

● ***SEPTEMBER 22***
BIRMINGHAM DISTRICT
Queenstown Lake
ANNUAL OUTING

C. V. Nass, Pettibone Mulliken Corp., Chicago, speaking at the May 19 meeting of the Southern California Chapter on "Progress in the Mulling of Foundry Sands." Mr. Nass prefaced his talk with a film showing high speed mulling.

who spoke on *"Progress in Mulling of Foundry Sands."*

As a preface to the speech which was to follow, the motion picture "High Speed Mulling" was shown through the courtesy of Beardsley and Piper Co.

At the conclusion of the film Mr. Nass talked briefly on the announced topic. He stated that the main reason for mulling is that nature has not provided the needed bonding in sand as taken from the earth, and that to get this bonding, or in order to get a synthetic sand, mulling is necessary. Other major reasons for mulling are the lowering of foundry costs due to: (1) reduced cleaning costs with smoother surfaces, (2) less scrap because of uniform grain distribution, (3) elimination of the use of nails, gaggers, etc.

The speaker said that "thorough mulling" results in need for less bonding materials in order to get the proper sand properties. This is a cost saver. "Under-mulling," the speaker said, is detrimental and is usually the result of a short mulling time or of increasing the load size in the muller without increasing the mulling cycle.

In finishing his talk, Mr. Nass stressed the importance of having accurate containers and mixture measurements. Having an intelligent muller operator who will maintain consistency and absorb knowledge was suggested as a wise investment for any foundry.

Presentation of awards was made to the winners of the prize essay contest, directed by E. K. Smith, consulting metallurgist, and sponsored by this chapter. Winner of first prize was Keizo Suenaga of Pasadena City College, whose essay was entitled *"Important Facts of Foundry Operation."*

June 9 meeting was held at Rodger Young Auditorium and was set aside, as is the custom once yearly, for the purpose of transacting the chapter's year-end business.

At the conclusion of the dinner, Earle Shomaker of Kay Brunner Steel Products Inc.; the outgoing president, made the President's Report. All of the officers and chairmen who served

Attending Western Michigan Chapter's "Kick Off" Dinner for Annual Picnic Committee Chairman were, left to right, front row: W. J. Cannon, J. E. O'Toole, E. Nelson, M. T. Borgeson; C. H. Cousineau, C. N. Jacobson, F. W. Cooper, E. Jensen and F. DeHudy. Back row, left to right: K. C. McReady, R. H. Herbst, C. H. Lloyd, C. Settergren, S. H. Davis, R. P. Schaffer, L. D. Ramsey, Robert DeVore and V. L. Tietsort.

Snapped by Chapter Photographer C. E. Silver, Texas Electric Steel Co., at the April 21 meeting of the Texas Chapter, held at the Angelina Hotel, Lufkin, were, left to right: Malcolm Henley, Texas Foundries, Inc.; Chalmer Cline, American Wheelabrator & Equipment Corp.; E. P. Trout, Lufkin Foundry & Machine Co.; and Chairman W. H. Lyne, III, Hughes Tool Co.

in Mr. Shomaker's cabinet made their reports. Mr. Shomaker complimented these officers and chairmen for their good work.

Following the reports, the new officers were installed. Outgoing president Earle Shomaker, Kay Brunner Steel Products Co., presented the chapter bell to Incoming President John E. Wilson of the Climax Molybdenum Co. This bell was won a number of years ago by our chapter for its showing in the National Membership Contest, and it has been used since then as a token of the presidency. Mr. Wilson presented all the members of his "cabinet" and thanked the chapter for past cooperation and asked for its continued interest and assistance.

All of the past presidents of the chapter were present and seated at their own table. Each past president, beginning with Robert Gregg, Reliance Regulator Div., American Meter Co., first chapter president and a National Director, made a resumé of the progress made by this chapter.

Texas

E. P. Clarke
American Wheelabrator & Equipment Co.
Publicity Chairman

APRIL 21 MEETING, held at the Angelina Hotel, Lufkin, was attended by 100 members and their guests, who assembled for dinner following plant visits to Lufkin Foundry & Machine Co. and Texas Foundries, Inc.

Speaker of the evening was Chalmer Cline, American Wheelabrator & Equipment Corp., who talked on "*Selection, Operation and Maintenance of Blast Cleaning Equipment.*"

The Lufkin meeting was arranged by E. P. Trout of the American Wheelabrator & Equipment Co.

Western Michigan

C. H. Cousineau
Carpenter Bros., Inc.
Publicity Chairman

"KICK OFF" Dinner for Annual Picnic Committee chairmen launched plans for the Chapter's Tenth Annual Stag Picnic, to be held at Pontaluna Golf Club, Muskegon, August 19.

Scheduled tentatively are a day of golf, a variety of games and awarding of many prizes. Festivities will conclude with a dinner and a floor show.

Twin City

J. D. Johnson
Archer-Daniels-Midland Co.
Chapter Reporter

LAST MEETING of the 1949-50 season was held May 23 and featured an interesting and instructive tour of the University of Minnesota's new Mechanical-Aeronautical Engineering building.

Initially, the group was informed by Professor Fulton Holtby as to the type of engineering graduates that are being prepared in the Institute of Technology of the University of Minnesota. He described the need for a middleman to serve as a link between production workers and the engineering staff. Personnel with a well-rounded background in technological fields is in great demand in industry, he stated.

The tour of the building was guided

Photographed at Central Indiana Chapter's "Past Chairmen's Night," May 12, by the International Harvester Co. staff photographer were (left photo) C. C. Spencer, left, Electric Steel Castings Co., congratulating Speaker R. A. Witschey, A. P. Green Fire Brick Co., on his talk; (center photo) Past Chairmen honored at the meeting were, left to right: Robert Langsenkamp, Langsenkamp-Wheeler Brass Works; Harold Lurie, Cummins Engine Co.; Richard Bancroft, Perfect Circle Corp.; J. P. Lentz, International Harvester Co.; Ray S. Davis, National Malleable & Steel Castings Corp.; B. P. Mulcahy, Fuel Research Laboratories, Inc.; and I. R. Wagner, Electric Steel Castings Co. (Right photo): Retiring Chapter Chairman S. F. Swain, Golden Foundry Co., congratulates Incoming Chairman Allen Reid, General Refractories.

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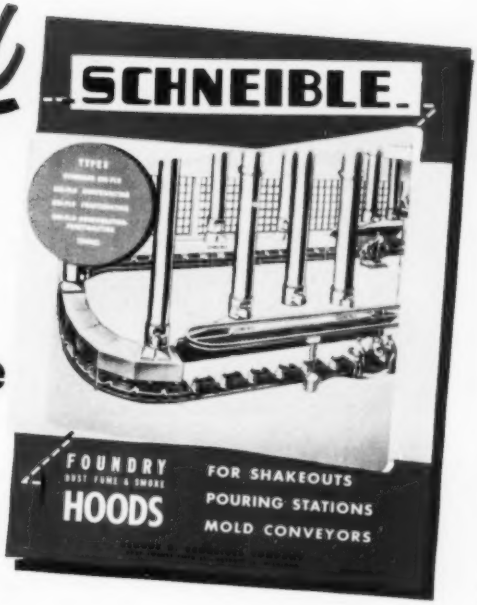

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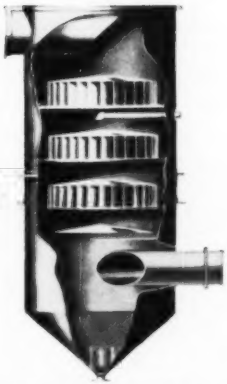

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MEMBER FEMA FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC.

New officers and directors of the Northwestern Pennsylvania Chapter, photographed at the May 22 meeting are, left to right seated: Director Joseph P. Shuffstall, National Erie Corp.; Evening's Speaker B. C. Yearley, National Malleable & Steel Casting Co., Chicago; and Chairman Frank Volgstadt, Griswold Mfg. Co. Standing, left to right: Secretary Earl M. Strick, Erie Malleable Iron Co.; Vice-Chairman Douglas James, Cooper-Bessemer Corp.; Treasurer Fred Carlson, Weil-McLain Co.; and newly-elected Chapter Director Bailey D. Herrington of Hickman, Williams Company, Inc.

by University of Minnesota Student Chapter members under John Uppgren, instructor in Foundry Practice.

Internal Combustion Engines, Woodworking, Plastics, Welding, Forging, Heat Treating, Sheet Metal Working, Machine Shop Practice, and Foundry Practice laboratories were described.

Of particular interest was the impressive new Foundry and its equipment, some of which was recently donated by local foundrymen.

Following the tour, a rehash of the excursion was completed over brimming cups of "foundry" coffee, served in the Foundry Laboratory by John Uppgren and his crew.

Northwestern Pennsylvania

Earl M. Strick
Erie Malleable Iron Co.
Chapter Secretary

MAY 22 MEETING, held at the Moose Club, Erie, featured a talk by B. C. Yearley, National Malleable & Steel Castings Co., Cicero, Ill., on *"Cracks and Tears in Ferrous Castings."*

In one of the most informative talks in chapter history, Mr. Yearley discussed this most important problem in malleable and steel castings production, stating that there are two types of cracks in castings that cause them to be scrapped—high temperature hot tears or shrink cracks, and low temperature strain or cold cracks. These occur, Mr. Yearley said, because forces within the casting are greater than the ultimate strength of materials used.

Most high temperature cracks are caused by metals, the speaker continued, or by gating, cores and molding sands. The latter two are the worst offenders, he said, because of the variables in mixing and rapping of sands.

The speaker stated that mold conditions must allow castings to stretch or contract at all times and suggested that test patterns be used to show any variables which might occur in metal change or core and mold hardness, and said that temperature differences should be eliminated if possible.

Prior to the technical session, Retiring Chairman Joseph Shuffstall announced chapter officers and directors elected for 1950-51, they are:

Chairman, Frank Volgstadt, Griswold Mfg. Co.; *vice-chairman*, Douglas James, Cooper-Bessemer Corp.; *secretary* (re-elected), Earl M. Strick, Erie Malleable Iron Co.; and *treasurer*, Fred Carlson, Weil-McLain Co.

Directors (to serve three years): C. S. Ban, American Brake Shoe Co.; Duane Davis, Urick Foundry Co.; and Bailey Herrington, Hickman, Williams & Co., Inc. *Director (to serve one year):* Joseph Shuffstall.

Mr. Shuffstall, who was given a rising vote of thanks for his work as chapter chairman during the past year, in turn thanked chapter members for cooperation and assistance during his term of office. He then introduced the chapter's new officers.

Northeastern Ohio

R. H. Herrmann
Penton Publishing Co.
Publicity Chairman

MAY 25 MEETING, held at the Tudor Arms Hotel, Cleveland, was titled "Old Timers' and Past Presidents' Night" and featured election of 1950-51 Chapter officers and directors. Of the 225 members present, approximately 75 were old timers.

Heading the group of past presidents was Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, first president of the chapter (1935-36) and President-Elect of A.F.S. In recognition of the latter honor, Mr. Woody was presented a brief case by the chapter. In a short talk on A.F.S. activities he stated that next year's technical convention will be held at Buffalo.

Other past presidents at the meeting

On display at the Southern California Chapter's June 9 meeting were winning patterns and castings entered in the Chapter's Apprentice Contest. Inspecting the display are, left: Frank Mittel, Lincoln Foundry Co., and right, James Eppley, Axelson Manufacturing Co., Chapter past president.

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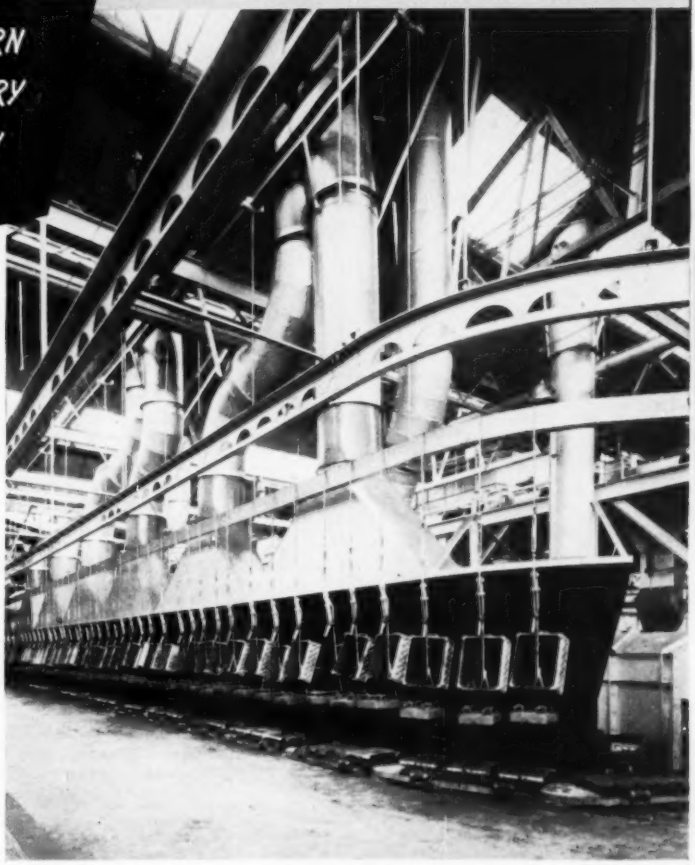

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included: Leroy P. Robinson, Archer-Daniels-Midland Co. (1938-39); Frank J. Dost, Sterling Foundry Co. (1941-42); Jack H. Tressler, Hickman, Williams & Co. (1942-43); James G. Goldie, M.B.M. Foundry (1943-44); Russell F. Lincoln, Russell F. Lincoln & Co. (1944-45); A. C. Denison, Fulton Foundry & Machine Co. (1945-46); Henry J. Trenkamp, Ohio Foundry Co. (1946-47), and Howard C. Gollmar, Elyria Foundry Division (1947-48).

Officers elected for the coming year are: Fred J. Pfarr, Lake City Malleable Co., *President;* Gilbert J. Nock, Nock Fire Brick Co., *vice-president;* Arthur J. Marlan, Hickman, Williams & Co., *secretary*, and F. Ray Fleig, Smith Facing & Supply Co., *treasurer*.

Directors for 3 years are: R. J. Hines, Hines Flask Co.; S. E. Kelly, Eberhard Mfg. Co.; J. J. Kroecker, Aluminum Co. of America; M. C. Ross, Bellville Foundries Inc., Bellville, O., C. F. Walton, Case Institute of Technology.

William G. Gude, Penton Publishing Co. immediate past president, was elected a director for one year.

Massachusetts Institute of Technology

Robert N. Randall
Retiring Secretary-Treasurer

TAKING OFFICE effective May 1 are the following new officers and directors of the MIT Student Chapter:

President, R. Waldemar Niemela; *vice-president*, Bernard J. Alperin; *secretary-treasurer*, Charles Herbert; and *technical secretary*, Eugene Rapperport.

Chesapeake

Jack H. Schaum
National Bureau of Standards
Chapter Reporter

POPULARITY of plant visits was again evidenced by a large turnout of chapter members for a tour of the world's largest copper refinery—the Baltimore plant of the American Smelting & Refining Co.

Visitors followed the progress of blister copper as it was mechanically charged into 325-ton, oil-fired reverberatory furnaces, melted, "poled" with green tree trunks, and cast into 700-lb anodes. The impure anodes are electrolytically refined in lead lined tanks containing sulfuric acid and copper sulfate. The resulting pure cathodes are remelted and cast into wire bars, wedge cakes, slabs, billets, ingots and ingot bars.

The men gathered at the Engineers' Club late in the afternoon for cocktails and dinner, followed by an interesting talk by a Baltimore Traffic Court Judge and concerning the influence of drinking on traffic accidents.

(Continued on Page 95)

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FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 616 S. Michigan Ave., Chicago 5, Ill. Refer to the items by means of the convenient code numbers.

50 Years of Silica Sands

JL101—Celebrating the golden anniversary of its production of foundry, glass and blast sands, Ottawa Silica Co. has published a handsome 24-page brochure detailing the history of the company, its development through 50 years and its services and policies. Company expansion into production of a diversity of products, including flint shot, flint silica, powdered silica, natural bonded molding sands, crystal silica for glassmaking and mineral abrasives is told in this illustrated brochure. *Ottawa Silica Co.*

Foundry Engineering

JL102—Eight-page illustrated booklet outlines many services performed by a foundry engineering organization. Included are foundry engineering (comprehensive analysis of foundry problems and development of modern methods), foundry layout (rearrangement of facilities for simplicity, efficiency and economy), architectural planning (from slight building changes to design of complete new plant), foundry modernization (overall plan to include latest foundry methods and rearrangement of existing and new facilities), foundry management (entire plant management for specified periods on commission or fee basis, consulting service), production and cost control, job evaluation and incentive plans. Included in booklet is brief history of this foundry engineering organization. *Lester B. Knight & Associates, Inc.*

Useful Foundry Information

JL103—Originally printed in 1946, "Useful Information for Foundrymen," handy pocket-sized booklet is now available in new edition containing 42 pages of facts, figures, formulae, brick counts, fuel costs, etc. Highlights of booklet include pointers on cupola operations, cupola linings data, slagging information, electric furnace data, melting and annealing methods for malleable iron, temperature color scale, fusion points, thermal properties of metals, melting points, combustion data, crane speeds, ladle data and tables of metric equivalents, etc. *Whiting Corporation.*

Metallurgical Apparatus

JL104—Booklet describes research polishing desk designed to aid metallographers who require exceptional speed latitude and convenience. 12 in. wheel is provided with electronic variable speed control for 100 to 1200 rpm. Water is available by button control for moistening cloth or washing specimen. Modern design, flyleaf with clamps for emery paper grinding. *Buehler, Ltd.*

Testing Machine

JL105—Bulletin 310 describes new, low-cost Model 60-H universal testing machine of 60,000 lb capacity. Four-page bulletin explains and illustrates machine's operations and controls, and emphasizes its features. Specifications and accessories are given. *Baldwin Locomotive Works.*

Compressed Air Power

JL106—Containing extensive basic reference data on compressed air and gas power, 18-page free booklet is designed as a general non-technical review of compressed air applications to machines. Booklet is divided into three sections (1) Uses—illustrated with cutaway photographs and drawings, (2) Theory—background material on compressed air usage, plus details on such topics as heat of compression, compressor capacity, etc., and (3) Types of Compressors. *Committee on Engineering Education of the Compressed Air and Gas Institute.*

Water Miscible Resin

JL107—New information on NVX, a water-miscible, neutral resin for foundry applications, is available in a new leaflet. Included in the information is a summary of comments from foundrymen who have used NVX for periods ranging from 6 to 18 months. Advantages claimed by manufacturer are: improved flowability and working quality of sand; better molds and castings; appreciable reduction in number of jolts required to produce same mold density, more uniform ramming; and particular value in squeeze work where no allowance can be made for poor flowing sand. *Hercules Powder Co.*

Industrial Lubricants

JL108—A four-page pamphlet dealing with colloidal graphite as an additive to industrial lubricants describes: (1) a colloidal graphite dispersion in oil—for lubricating internal combustion engines and industrial machinery; (2) a concentrated dispersion of colloidal graphite in mineral spirits for use in high-temperature lubrication of oven convevor chains, permanent mold push pins and foundry ladles. *Acheson Colloids Corp.*

Threading Stainless Steel

JL109—A folder, "Don't Fear Threading of Stainless," cites actual case studies, including speeds, tool angles, coolants, etc., to show that properly trained personnel, using carefully selected equipment, can thread and tap stainless steel at high production rates, while achieving uniformly high quality. *Cooper Alloy Foundry Co.*

Reader Service, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago: Please send me literature on the following items circled below, without charge or obligation:

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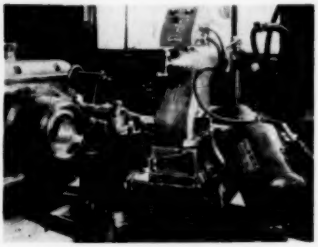
NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 616 S. Michigan, Chicago 5, Ill. Refer to the item by means of the convenient code numbers.

Machine Tool Duplicator

JL1—Electronically-controlled duplicator attachment for machine tools features simplicity of operation and smooth control over slight changes in contour, combined



with ability to make abrupt changes in contour without overshooting. Installations have proved successful in turning molds and complex contours of rolls, axles and other irregularly-shaped parts. *Raytheon Mfg. Co.*

Core Drawing Machine

JL2—Model CD-36 core drawing machine performs complete core-draw cycle in as little as 18 seconds and will operate with any type of core blower. As illustrated in strip below one operator (1) easily positions core box, (2) pneumatically lifts core box, manually rolls it over, positions core plate supports on machine bed, (3) lowers core box and removes plate clamps, (4) permitting box to be drawn automatically for core removal and subsequent handling. Air powered by standard 80 psi line pressure, machine features enclosed lifting mechanism (front and rear) and one-piece lifting yoke. Adjustable second stop is automatically placed in operation by four-way operating control valve to limit lowering of core box prior to draw. Unit handles core boxes from 24 to 36 in. in length and guide rail width is supplied to meet individual requirements. Hinged yoke trunnion can be furnished for handling deep core boxes. Operating cycle requires 18 to 42 seconds, depending upon types and sizes of cores. *Spo, Inc.*

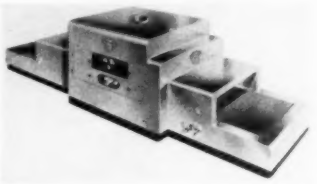
Current-Collector Material

JL3—Graphitar, a self-lubricated, inert carbon-graphite material is now being used for current-collector wheels on electric cranes. Graphitar, because of its self-lubricating properties, makes bushings unnecessary and eliminates greasing of trolley wires. Almost total elimination of

pitting, arcing and burning reduces chance of dead spots. Graphitar is unaffected by operating heat or fumes, by cold, rain, sleet or snow. *United States Graphite Co.*

Electronic Core Baking Tunnel

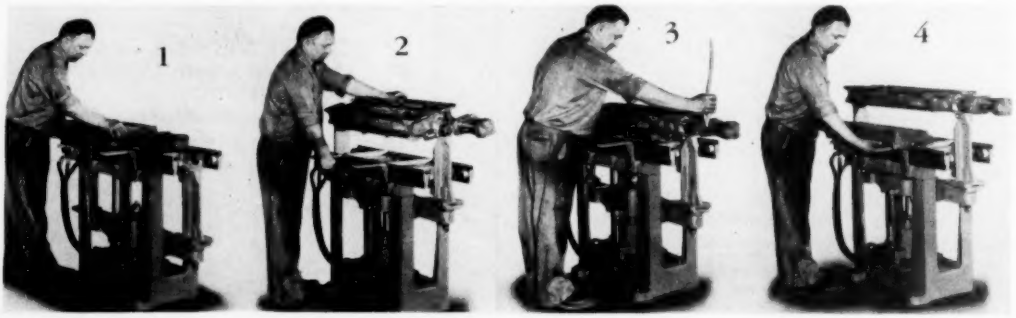
JL4—Model M-7200 thermonic electronic core baking tunnel bakes cores evenly throughout with average baking cycle of a few minutes and has a capacity of 4 tons of cores per hour. Unit bakes cores up to 60 in. wide with maximum combined height of core and core plate of



20 in. Approximate overall dimensions of tunnel are 8 ft wide x 8 ft high x 25 ft long. Conveyor speed adjusts from 0 to 6 fpm. Green cores may be loaded in core room directly onto tunnel conveyor, eliminating racking and much of handling in green state. Following baking cycle, core plate may pass directly to inspection table. No cooling period is involved and cores are ready for immediate use. Green strength, hot strength, hardness, collapsibility and other core characteristics can be controlled. Advantages: overcomes hot tears, burn-ins, poor finish; core residue may be removed without mechanical assistance, reduces gassing and need for venting molds and cores, cuts mulling time. *Induction Heating Corp.*

Hand Cleaner

JL5—Antiseptic industrial cream hand cleaner, scientifically-compounded, thoroughly removes industrial hand soil, and at the same time discourages dermatitis, soothes and aids chapped hands, cuts



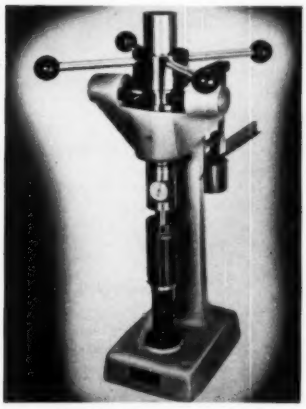
and scratches. Easily-installed dispenser is available for compound, which removes dirt, grease, grime, paint, varnish, shellac, soldering fluxes, etc., with or without use of water. Cleaner is available in 4 lb or 12 oz cans. *Amaza Laboratories.*

Air Line Lubricator

JL6—Airlube control unit, a low pressure air line purifier and lubricator removes oil, moisture and dirt from air and gas lines, at the same time providing finely atomized lubrication. First of two basic sections of unit, the Pur-o-fier precipitates water and oil by scrubbing action and cleans with series of impinging baffles. Conventional screens are eliminated to prevent clogging while transparent bowl provides visible check of dirt entrainment. Unit has 45 cf capacity and withstands up to 250 psi. Other basic part of unit, the Pur-o-luber, regulates delivery of suspended oil vapor in accord with changes in air pressure and is claimed to deliver perfect lubricating film that will adhere to any surface contact. Unit operates under maximum 125 psi. Oil reservoir has half-pint capacity. Pur-o-fier and Pur-o-luber can also be supplied as separate units. *Airlube, Inc.*

Sand Press

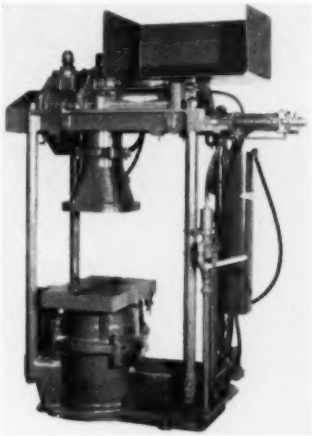
JL7—New device for ramming foundry sand specimens, the Sand Press rams sand to specific hardness by applying selected squeezing load to sand sample in test mold. Green hardness tester forms integral part of ramming plunger, allowing operator to know hardness to which sand is rammed. Individual sand specimen or core sand mixture is rammed to same



hardness degree in laboratory as in foundry, and is tested at same green hardness. Method permits more practical test data than are obtained when materials are rammed in laboratory with identical force but with varying green hardness. *Harry W. Dietert Co.*

Foundry Equipment Controls

JL8—Improved automatic controls exhibited at the 54th A.F.S. Foundry Congress & Show include those for a core blower. Operating cycle of clamping core box, blowing core and refilling sand reservoir is automatically performed safely with one manual control valve. Cycle is automatically terminated after each core



is blown. Control can be used for either diaphragm or draw type core blowers. For diaphragm machines average cycle is about 4 seconds and blowing is adjustable. On draw type machines, cycle varies from 8 to 12 seconds, depending upon length of draw required for core. Blowing time and vertical clamping pressures are adjustable to suit job conditions. *Osborn Mfg. Co.*

Truck Battery Charger

JL9—Single-circuit rotating battery charging equipment for electric industrial trucks is versatile and fully automatic, has more than 2000 available adjustments of charging characteristics to meet requirements of all types of battery trucks. One model covers acid-lead batteries of 12 to 20 cells up to 530 amp-hr capacity and 21 to 24 cells up to 450 amp-hr, and nickel-iron-alkaline batteries of 20 to 24 cells up to 460 amp-hr. Other model covers lead-acid batteries of 12 to 20 cells up to 750 amp-hr capacity and 21 to 24 cells up to 630 amp-hr, and nickel-iron-alkaline batteries of 20 to 24 cells up to 700 amp-hr capacity and 25 to 32 cells up to 600 amp-hr. Features of unit include: Battery cut-off and charger shutdown when battery is fully charged; automatic disconnection of charger from power line, opening of charging circuit in case of interruption, and automatic restart of charger following interruption. Control of charging rate is automatic. *General Electric Co.*

Dump Bucket

JL10—Completely redesigned line of tip-over and self-righting dumping buckets features simplified, all-welded design in place of riveted construction. Buckets are furnished in standard weights for handling foundry sand, ashes, refuse, etc.,

and in heavyweight sizes for handling ore, crop ends, etc. Illustrated is Model D-27, with 27 cu ft capacity, weighing 760 lb. *Blaw-Knox Co.*

Plastic Safety Glove

JL11—Plastic safety work glove, claimed by manufacturer to outwear rubber or leather gloves, have more flexibility and to be impervious to oils, acids, caustics and water, will not become slippery when wet and will withstand greater abrasive action. Available in four models: No. 2100, knit wrist; No. 2102, two-inch cuff; No. 2105, gauntlet; and No. 2100A, palm-coated. *Milburn Co.*

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FOUNDRY FIRM Facts

General Electric X-Ray Corp., Milwaukee, announces inauguration of a new "packaged" x-ray service, complete with equipment, maintenance, repair parts, tubes and instruction, all covered by a single monthly charge. Plan eliminates initial investment in non-destructive testing equipment for foundries, placing these facilities within range of a greater number of foundries and laboratories. Details are available from Department DG, General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

Lebanon Steel Foundry, Lebanon, Pa., has effected licensing agreements with the **Timken Roller Bearing Co.** to produce and sell "16-25-6," a patented heat-resistant super-alloy, for adaptation to steel casting processes, particularly those involved in manufacture of rotor wheels for turbo-superchargers, jet engines and gas turbine applications.

Illinois Clay Products Co. announces the removal of its sales offices to Suite 970-4, 208 S. LaSalle St., Chicago 4. Telephone is DEarborn 2-6013.

Industrial Electronics, Inc., Detroit, announces the formation of a new Technical Service Center, with W. T. Bean, Jr., previously in charge of the Stress Analysis Laboratory of Continental Motors, heading the Center. Mr. Bean will combine his activities in experimental stress analysis with the work of the staff of Industrial Electronics, Inc., to provide a consulting service.

Shown in operation, this electric furnace, one of two recently installed by Electric Steel Foundry, Portland, has a production schedule calling for a 6500-lb heat every hour-and-three-quarters.

Ilium Corp. is the new name of the **Burgess-Parr Co.,** Freeport, Ill. Effective June 1, the company's new title was selected to replace the Burgess-Parr name because of closer association with the company's principal product, Ilium, a corrosion resistant alloy developed by Dr. Samuel W. Parr some 20 years ago.

H. Kramer & Co., Chicago, has purchased the plant, equipment, inventory and metal trade marks of **Ajax Metal Co.,** Philadelphia. The plant will be operated as the **Ajax Metal Division of H. Kramer & Co.** and will continue to produce brass and bronze ingot, phosphor copper, babbitts and other alloys for the foundry industry. No change of operations or personnel is contemplated for the new organization, which will be headed by E. A. Ginkinger, who has been named vice-president and general manager of the Division. Dr. G. H. Clamer, president of the Ajax Metal Co., states that the company is changing its name to the **Ajax Electro Metallurgical Corp.,** and with its associated companies, Ajax Electric Furnace Corp., Ajax Electrothermic Corp., Ajax Electric Co., Inc., and Ajax Engineering Corp., will continue to manufacture electric furnaces and metallurgical equipment. Dr. Clamer will become president of the new Ajax Electro Metallurgical Corp., and will continue as president and technical advisor of the associated companies.

Johnson-March Corp., Philadelphia, announces its new "Liquid Diffusion" engineering service, based on scientific application of liquid diffusion compounds to eliminate dust, speed core knock-out, permit faster mixing of core sand, provide better moisture distribution in heap and facing sand, and control cupola stack dust emissions. Johnson-March officials announce that the company's engineers are prepared to design and install liquid diffusion systems to meet all needs.

Giffels & Vallet, Inc., Detroit, has opened a Houston, Texas, office in conjunction with **Associated Engineers and Architects,** also of Detroit. The new office located at 2121 Commerce Bldg., Houston, will maintain a staff of engineers, architects and technicians to provide complete engineering and design services for industry. Col William P. Cornelius, formerly chief of construction and maintenance for the Hanford Atomic Energy Project, will head the Houston office.

Allis-Chalmers Mfg. Co., Milwaukee, has appointed **Picker X-Ray Corp.,** New York, to handle promotion, sales, installation and servicing of Allis-Chalmers betatrons for both industrial and medical applications. Allis-Chalmers will assist Picker on engineering applications as needed.

Manhattan Rubber Div., Raybestos-Manhattan, Inc., Passaic, N. J., recently honored 46 employees who have completed 25 years of sevice with the Division, at the Sixth Annual Dinner of the Manhattan Pioneers. The group now numbers 600 company veterans. The 46 new pioneers received gold lapel buttons, while members entering new five year groups were presented with additional diamond studs.

Workmen pouring molten aluminum into pig form at the Aluminum Company of America's Point New Comfort Works, aluminum reduction plant built on Matagorda Bay near Port Lavaca, Texas. Plant is located on 3,000 acre tract and has 25 buildings covering some 81½ acres of floor space and housing engine rooms for power production, pot rooms and carbon plant.

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In the Apex laboratories, Apex research and facilities are devoted to producing *better* ingot, analyzing particular problems for foundries who use *all* methods of castings—sand, permanent mold or die casting. Thus, Apex maintains always this high standard: "Best in every test from Ingot to Casting!"

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Foundry Materials Inventory

65—Irregularities Are Quickly Adjusted. Albert E. Grover, "Inventory Control," *The Foundry*, vol. 78, Apr. 1950, pp. 80-85, 125, 126.

The advantages of maintaining a perpetual inventory of foundry materials and supplies are presented. Some of these are: no delay in preparing yearly operating statements; the inventory investment is available on a monthly basis; and the irregularities that may result in inventory quantities and values in respect to production can be quickly rectified. Details are given of an effective method of inventory control, together with the forms required for its use.

Brief Notes for Busy Foundrymen

The Advantages of Southern Bentonite in STEEL

Recently there has been a trend to add Panther Creek bentonite to steel foundry sands. The chief reason for this addition is to obtain better collapsibility, less cleaning and shake-out expense. Panther Creek having low dry and hot compression strengths enables the foundryman to obtain these results.

Several steel plants rebond backing sand with Panther Creek to avoid lumpy sand conditions after the heat has penetrated the mold. They have found that very small percentages of Panther Creek are required, depending upon the strength of the backing sand before rebonding. However, additions of Panther Creek to the backing sand have usually been from 1%-2% by weight.

Since Panther Creek may be worked with low moisture, dry strength is further decreased as high moisture content increases the dry strength of the sand and results in difficult shake-out.

Another steel foundry adds Southern Bentonite to dry sand work to prevent cracked castings and to help eliminate sand baking in pockets and recesses, because the casting cannot be shaken-out too quickly.

With small steel castings, as much as 75% Panther Creek may be used to give better flowability to the sand, resulting in denser and more even ramming. This type of ramming peels easily, and gives casting a very smooth finish.

Cereals, wood flour, and organic binders may be decreased by using Southern Bentonite, as many like properties are developed. However, mold skin hardness is decreased when clay-like bonds are added and their properties can only be obtained by spraying the surface of the mold with Glutrin, molasses, or dextrine waters.

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Cupola Blast Control

66—Melting and Air Supply Rates. N. P. Piennaar, "Cupola Operation. The Proportional Blast System," *Iron and Steel*, vol. 23, Apr. 1950, pp. 111-115.

The conventional constant-blast system of cupola operation has several inherent disadvantages which may be obviated by operating under the proportional blast method of controlled variation in air supply. The new method, based on the experimentally determined equivalence between melting rate and rate of air supply, involves supplying air to the cupola in accordance with a delivery time curve corresponding to which a predetermined melting schedule may be followed. Theoretical and practical details are given, and the advantages of the new techniques are enumerated.

Nodular Iron Production Data

67—New Engineering Material. Donald J. Reese, "Economic Considerations in Producing Magnesium-Containing Iron," *The Foundry*, vol. 78, May 1950, pp. 120-125.

The production costs, applicable raw materials and specifications for magnesium-containing iron castings are presented. The specifications for irons containing 0.10 per cent or less of phosphorus are listed below (minimum values only are given):

Grade	Type	TS 100 psi	YS 100 psi	% El
90-65-02	Pearlitic Ferritic	90	65	2.0
80-60-05	Pearlitic Ferritic	80	60	5.0
70-50-08	Pearlitic	70	50	8.0
60-45-15	Ferritic	60	45	15.0

Auxiliary Shakeout Equipment

68—Mechanize Operation. Robert H. Herrmann, "Handling Materials at the Shakeout," *The Foundry*, vol. 78, Apr. 1950, pp. 90-95, 229-230.

The use of electric hoists, vibrators, automatic dumping of molds, use of belt conveyors to carry hot sand and castings to and from vibrating shakeout, and oscillating conveyors are described. Magnetic equipment is used for removing tramp ferrous metal from shakeout sand.

Cast Forming Tools

69—Maintain Close Foundry Control. G. A. Robinson, "Aircraft Punch and Die Casting," *Iron Age*, vol. 165, Mar. 23, 1950, pp. 65-68.

In the production of dies and punches which are used to accurately reproduce air flow contours, it is necessary to maintain close foundry control. An analysis is made of the original metal and remelted material to see that they meet the required specifications. Tables are given which show the analysis limits. Careful measures are taken to prevent metal contamination. The various steps required to make dies and punches are described.

British Steel Foundry

70—Mechanization Doubles Production. "Mechanized Steel Foundry," *Mechanical Handling*, vol. 37, Mar. 1950, pp. 49-51.

Production in a steel foundry was doubled by the introduction of mechanical handling devices with only a small addition in floor space. The melting process, sand handling equipment, molding machines, core shop, casting floor, shakeout equipment, etc., are discussed.

Foundry Production Planning

71—Departmental Cooperation. Chester V. Nass, "What the Foundry Expects of the Pattern Shop," *The Foundry*, vol. 78, May 1950, pp. 132-133, 306-309.

For economic and efficient production of castings cooperative planning is required between the engineering department, pattern shop, and foundry. Efficient operation requires knowledge of the number of castings to be made from the pattern equipment (this is furnished by the production department) and agreement between pattern shop and foundry concerning the type of pattern best suited to the foundry's equipment and facilities.

Coordinate Foundry Departments

72—Eliminate Costly Errors. A. Pettie, "Pattern Engineering and Foundry Practice," *Canadian Metals*, vol. 13, Mar. 1950, pp. 24-27, 49.

The author states that due to lack of coordination between pattern engineer, patternmaker, foundryman, and machinist, costly errors often result. Some of these are described with illustrations. The phases considered are pattern partings, design of gates, flask equipment, barring of flasks, clamping of flask, over-all size of flask, height of flask, and casting machining.

Cast Iron Cooling Rates

73—Component Transformation. Armand Descy, "Solidification and Structure of Cast Irons," *Fonderie*, no. 51, Mar. 1950, pp. 1973-1981 (in French).

This is a study of the following paradoxical behavior of cast irons: in thick pieces the high ferrite cement is due to the slow cooling of the inner parts; on the other hand, in many instances fast cooling also determines a high content in ferrite. These relationships are explained by distinguishing between two processes connected with the rate of cooling, viz., the solidification and the physico-chemical transformation.

Old and New Chilled Iron

74—Aging Required. A. Bichler, "Durability Problems of Chilled Cast-Iron Rolls," *Hutnické Listy*, vol. 5, Mar. 1950, pp. 89-93 (in Czech).

The high durability of some chilled cast-iron rolls, scrapped in 1935-1937, was compared, statistically, with that of rolls recently fabricated. It was concluded that the present-day product is not inferior to the pre-war one, provided the rolls are allowed a sufficiently long aging period, and are treated with necessary care in the rolling mill.

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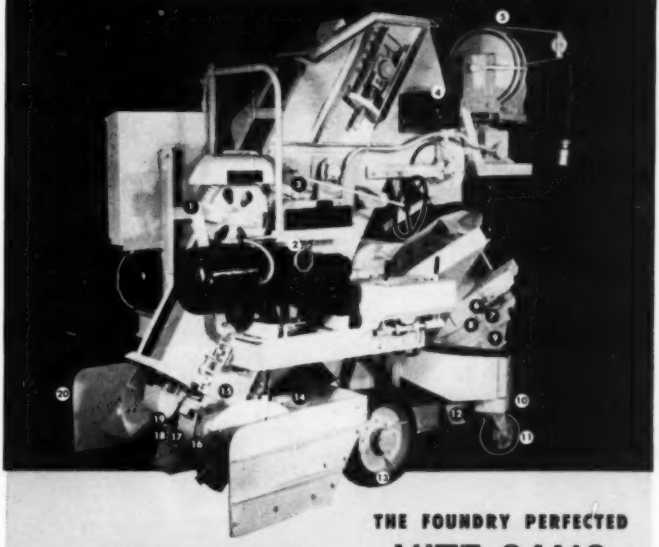

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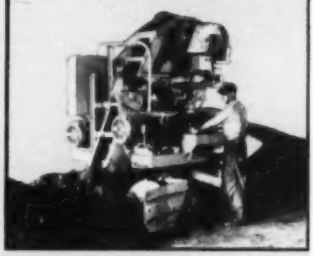

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(Continued from Page 24)

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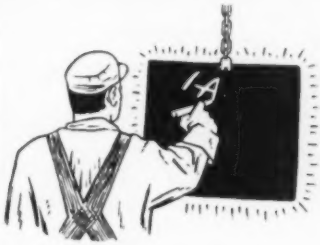

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A.F.S. GLOSSARY

(Continued from Page 41)

Baumé — A measure of specific gravity of liquids and solutions reduced to a simple scale of numbers.

bauxite—An ore of aluminum consisting of moderately pure hydrated alumina, $Al_2O_3 \cdot 2H_2O$.

bay — Longitudinal division of foundry floor.

bayberry wax—Wax made from bayberries, used for coating patterns.

beam and sling—Tackle used in conjunction with a crane for turning over the cope or drag of a mold prior to assembly.

bed or bed charge—Initial charge of fuel in cupola on which the melting is carried on.

bedding a core — Resting an irregular-shaped core on a bed of sand for drying.

bed-in—Method whereby drag may be rammed in the pit or flask without necessity of rolling over; process used for production of heavy castings.

bellows—A baglike hand-operated air blowing device for removing loose sand or dirt from molds or parting sand from patterns.

bench molder—A craftsman who makes molds for smaller type castings, working at the molder's bench only.

bentonite — A colloidal clay derived from volcanic ash and employed as a binder in connection with synthetic and silica sands, or added to ordinary natural (clay bonded) sands where extra dry strength is required; found in South Dakota and Wyoming, also in Africa and India.

Bessemer ladle — A steel ladle, lined with refractory material, and having a stopper and nozzle system of pouring, i.e., bottom pouring, as distinct from tilting the ladle.

Bessemer process—Process for making steel by blowing air through molten pig iron contained in a suitable vessel, and thus causing rapid oxidation, mainly of silicon and carbon.

binary alloy — An alloy containing two principal elements.

binder — Material to hold sand grains together in molds or cores, such as cereal, pitch, resin, oil, sulphite by-product, etc.

blackheart—American type malleable iron, normal fracture showing a velvety black appearance with a gray rim.

black lead — A form of graphite used for sleeking green sand molds; applied as a water suspension to skin-dried molds.

black wash — A combination of blacking and plumbago applied as a water suspension to mold and core; it is customary to introduce a bonding agent such as bentonite, fireclay, dextrin, molasses, etc.

blacking — A thin facing of carbonaceous materials, such as graphite or powdered charcoal, used to finish mold surfaces and protect the sand from the hot metal.

blacking holes — Irregular-shaped surface cavities containing carbonaceous matter, sometimes found in defective cast iron castings.

blacking scab—A casting defect formed by blacking flaking off due to sand expansion and being retained in or on the surface of the metal.

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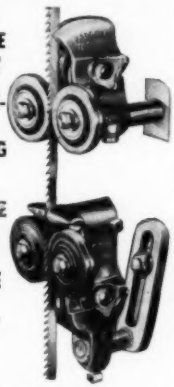

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blast – Air driven into the cupola or furnace for combustion of fuel.

blast cleaning – Removal of sand or oxide scale from castings by impinging action of sand, metal shot or grit projected under air, water, or centrifugal pressure. See BLASTING.

blast furnace – In ferrous metallurgy, a shaft furnace supplied with an air blast (usually hot) and used for producing pig iron by smelting iron ore in a continuous operation. The raw materials (iron ore, coke and limestone) are charged at the top, and the molten pig iron and slag, which collect at the bottom, are tapped out at intervals. In nonferrous metallurgy, a shaft type of vertical furnace used for smelting coarse copper, lead and tin ores; similar to the type used for smelting iron, but smaller.

blast gate—Sliding plate in the cupola blast pipe to regulate flow of air.

blast meter—Instrument for indicating volume or pressure or both, of air passing through the blast pipe on a cupola.

blast pipe – Pipe for conducting air under pressure; usually refers to the section between blower or fan and cupola.

blast pressure—Pressure of air in blast pipe or wind belt of cupola depending on location of indicating instrument; usually given in ounces of water pressure.

blasting—A process for cleaning or finishing metal objects by use of air blast that blows abrasive particles against the surfaces of the work pieces. Small, irregular particles of steel are used as the abrasive in *grit blasting*, sand in *sand-blasting*, and steel balls in *shot blasting*. See BLAST CLEANING.

bleeder – A defect wherein a casting lacks completeness due to molten metal draining or leaking out of some part of the mold cavity after pouring has stopped.

bleeding—See SLUSH CASTING.

blended molding sands—Mixtures of molding sands made to produce desirable conditions.

blind riser – A riser which does not break through the top of the cope mold, and is entirely surrounded by sand; often combined with spin gates, together forming an efficient method of gating and feeding a casting.

blister—A shallow blow with a thin film of iron over it appearing on the surface of a casting.

bloating – Swelling of a refractory article due to formation of gases inside the material. These gases may be due to overheating or to presence of carbon monoxide in the furnace.

blow – Forcing of air through the molten metal due to insufficient venting; also commonly used to indicate starting up of a cupola.

blower – Machine for supplying air under pressure to the melting unit.

blow gun—Valve and nozzle attached to a compressed air line to blow loose sand or dirt from a mold or pattern; also to apply wet blacking.

blowhole – Irregular shaped cavities with smooth walls produced in a casting when gas, entrapped while the mold is being filled, or evolved during solidification of the metal, fails to escape and is held in pockets.

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blows—Rounded cavities, spherical, flattened, or elongated, in a casting, caused by the generation and/or accumulation of gas or entrapped air.

bond, bonding substance or bonding agent—Any material other than water which, when added to foundry sands, imparts bond strength to them.

bond strength—Property of a foundry sand by virtue of which it offers resistance to deformation.

bonding clay—Any clay suitable for use as a bonding material.

book mold—A split mold that is hinged at the side.

boric acid—An inhibitor commonly used as an additive to facing sand in connection with casting of magnesium-base and aluminum-magnesium alloys. The proportion varies between 0.5 to 2 per cent, depending upon the alloy composition and whether other inhibitors are used at the same time.

bosh—In a blast furnace (1) the section where the diameter increases to a maximum above the tuyeres; (2) a lining of quartz that is built up during pyritic smelting of copper, narrowing down the internal dimensions at the tuyeres.

boss—A projection on a casting of circular cross section.

bot—A cone-shaped lump of clay attached to the end of an iron or wooden "bot-stick" used to close the taphole of a furnace.

bot-stick—An iron rod, with a loop or long wooden handle at one end and a small round disc at the other, to receive the clay for botting off when the ladle is sufficiently full.

bottom board—A flat base of wood or metal for holding the flask in making sand molds.

bottom running or pouring—Filling of a mold from the bottom by means of gates from the runner.

bottom (sand)—Layer of sand with clay rammed on the bottom doors of the cupola to form the sloping hearth or crucible bottom.

box—See FLASK.

brass—Copper-base metal with zinc as the major alloying element.

brazing—Joining metals by fusion of nonferrous alloys that have melting points above 800 F but lower than those of the metals being joined. This may be accomplished by means of a torch (torch brazing), in a furnace (furnace brazing) or by dipping in a molten flux bath (dip or flux brazing). The filler metal is ordinarily in rod form in torch brazing; whereas in furnace and dip brazing the work material is first assembled and the filler metal may then be applied as wire, washers, clips, bands, or may be integrally bonded.

breast—Part of furnace lining connecting spout with bottom and made up with tap hole for every heat.

breeze—Coke or coal screenings.

bridging—Local freezing across a mold before the metal solidifies.

Editor's Note: Part II of the A.F.S. glossary of foundry terms will appear in the August issue. Criticisms and suggestions for revisal are welcomed.

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CHAPTER ACTIVITIES

(Continued from Page 81)

The technical talk was presented by Donald Lovett of the American Smelting & Refining Co. Research Laboratory at Perth Amboy, N.J. Mr. Lovett discussed aluminum foundry practice with emphasis on melting, pouring, molding, and permanent molds. Each category was accompanied by slides showing bad castings.

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MAY MEETING saw installation of Alfred A. Diebold, Atlas Steel Castings, Co., as chapter chairman.

Mr. Diebold has served four years as director of the chapter and was vice-chairman and program director last year. He has served for two terms as chairman of the Technical and Operating Group of the Steel Founders' Society of America and is a member of the Metallurgical Committee of the University of the State of New York School of Applied Arts and Science.

The following were elected as officers: *vice-chairman*, Erwin M. Deutschlander, Worthington Pump & Machine Corp.; *treasurer*, Martin W. Pohlman, Pohlman Foundry Co., Inc.; and *secretary*, Roger E. Walsh, Hickman-Williams & Co., Inc.

The new directors include Joseph M. Clifford, Bison Castings Co.; Joseph H. Sander, Tonawanda Electric Steel Castings Inc.; and William H. Oliver, American Radiator and Standard Sanitary Corp.

Birmingham District

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GOOD EATS and a good speaker on a timely subject brought out a good attendance at the last meeting of the year.

C. P. Caldwell, Caldwell Foundry & Machine Co., retiring chairman, presided over the dinner preceeding the technical session and introduced Biddle Worthington, McWane Cast Iron Pipe Co., who made the "coffee talk."

Mr. Worthington gave an interesting resumé of his recent trip to Europe, where a group from McWane visited a number of pipe manufacturing industries. Ross Martin and others accompanied Mr. Worthington.

Sam Carter, American Cast Iron Pipe Co., speaker for the technical session, was introduced by Morris Hawkins, program chairman. His subject, *"Future Possibilities of the Basic Lined Cupola,"* was of interest to the entire 110 in attendance.

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Melting and Refining Practices for Magnesium—by Charles E. Nelson. (With discussion.)
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HW529—Foundryman: capable of supervising heat and corrosion resisting alloy foundry. Age not over 50 with practical experience in foundry and B.S. degree in Metallurgy. Castings from ounces to a ton. Must have technical as well as practical background. Must be cost-minded and scrap conscious and will be expected to show results. State age, experience and salary expected; also enclose recent photograph.

HW531—Core Room Foreman: Large Southern gray iron foundry desires experienced man capable of supervising production and assembly of small to medium sized cores on highly repetitive work. Must be able to teach and coordinate making of cores on benches and blow machines. In replying please state age, experience, and salary expected.

HW532—Pattern Shop Supervisor: Capable of supervising design, rigging, and maintenance of metal pattern and core box equipment in large Southern production gray iron foundry. Please give references and full details of experience.

HW533—Basic Electric Melter: An experienced basic electric melter is needed by a Central Ohio steel foundry. Position not permanent but for purpose of establishing basic practice and training furnace personnel. Melting of carbon and low alloy steels will be involved. Salary detail given on application.

HW534—Time Study & Methods Engineer: Wanted by production foundry; medium and light ferrous castings. Located in Middle West.

HW535—Time Study & Methods Engineer: With steel foundry experience, wanted for permanent position in vicinity of Cleveland, Ohio. Good opportunity with well established company. Write stating experience, qualifications, and expected salary to start.

HW536—Sand Plant Manager: Want man with foundry experience to operate and manage sand plant located in Middle West.

HW537—Sales Engineer: National organization is seeking services of experienced, well-qualified sales engineer, between 35 and 40 years of age, who has a thorough knowledge of foundries and foundry practice, preferably one who has had extensive contacts with foundries in the Midwest. Salary will be commensurate with ability. All replies held in strict confidence.

HW538—Industrial Engineer: Nationally known consulting firm has opening for top flight engineer to take charge of industrial engineering division. Must know foundry operations, be able to make surveys and write reports. Supervise development and installation of wage incentives, job evaluation, production control, and standard costs. Enclose resume of experience in reply.

HW539—Permanent Mold Superintendent: Man capable of running permanent and semi-permanent mold shop from estimate through finished casting. Must be able to design molds. Metropolitan New Jersey area. State all qualifications in reply.

POSITIONS WANTED

PW142—Analytical Chemist: Experienced in analysis of all types of alloys; good knowledge of instrumental methods; publications; B.A. degree; age 32.

PW144—Maintenance Engineer: Available after July 1. Will locate anywhere. Wide experience, 21 years, in foundry maintenance—mechanical electrical, and preventive. Age 40; married.

PW145—Metallurgical Engineer: Have B.S. in metallurgy, 16 years' experience in aluminum die casting and permanent mold work, including plant control and process development problems, trouble shooting, customer service, operating supervision, and personnel training. Permanent mold estimating and design experience. General knowledge sand practice. Age 39. Prefer Eastern or Northwest location.

PW146—Foundry Metallurgist: Graduate engineer desires responsible position in foundry production and metallurgical control work. 8 years' experience in development of cast iron, steel, and high temperature alloy castings of all sizes. Experience in working on all types of production problems and applying new ideas in the foundry.

PW147—Manufacturer's Agent: Want quality casting lines on commission basis for state of Michigan. Have metallurgical and foundry production experience.

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Fig. 117—Bench-type Core Blowing Machine

Fig. 190—High-frequency Dielectric Core Baking Oven

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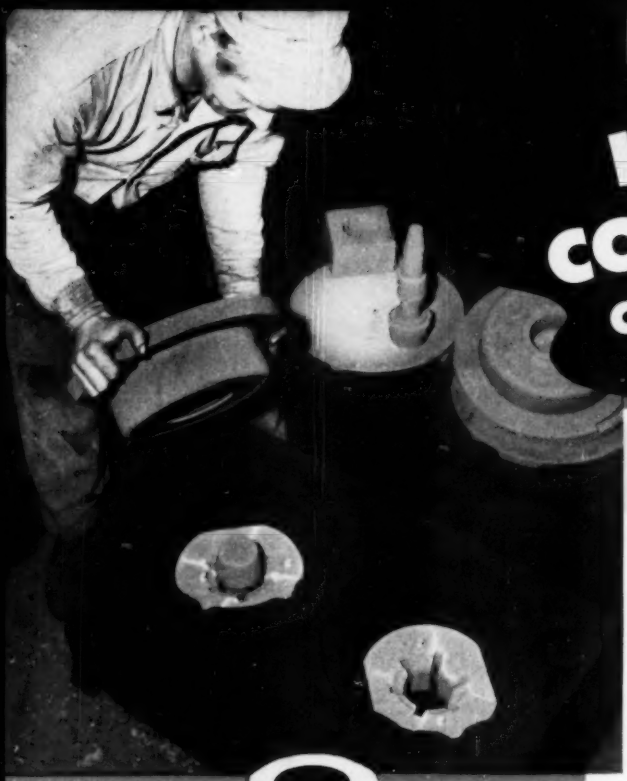

LINOIL COVER CORES— Cut Molding Costs!

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Certain castings, because of their design, can be made entirely in the drag of a mold. By eliminating the need for a cope, considerable savings can be realized in both time and equipment.

For instance, Wisconsin Cylinder Foundry casts tractor brake housings in this manner, using cover cores instead of a cope. The pattern is rammed-up in the drag, and all that's needed to complete the mold are three cores—a center core, a pin core, and a cover core.

In addition to the labor savings, dry sand gives a far smoother surface to castings than green sand could produce. Cleaning room costs are lowered and casting quality is increased.

LINOIL is used by Wisconsin Cylinder for all of their corework—interior cores, cover cores, and dry sand cylinder molds. *Dependable performance* and *economy of use* are the two most important factors in their selection of a core oil. Mr. R. L. Niess, president of Wisconsin Cylinder, says; "This foundry has used LINOIL continually for the past thirty years. We know we can depend on getting good cores at the lowest cost."

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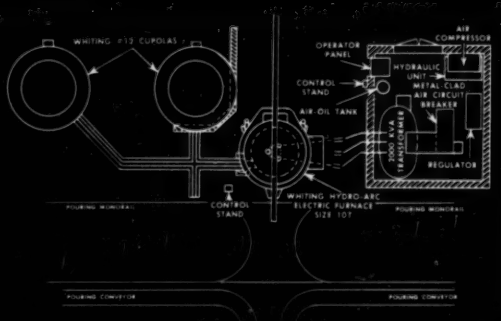
Duplexing installation in which hot metal is carried to the Hydro-Arc Furnace with a ladle.

Cupola-to-Electric DUPLEXING

—a solution to low-quality coke problems



Typical cupola-to-electric duplexing layout complete with pouring system

By using a Hydro-Arc Furnace that matches total cupola capacity, melters are increasing production, getting proper pouring temperatures at all times, and reducing machine shop rejections.

Other savings (such as continuity in pouring, increased yield from alloys, and finer grain castings of higher strength) help to make cupola-to-electric duplexing repay its entire cost in a comparatively short time.

The versatility of Hydro-Arc Electric Furnaces, combined with the ingenuity of Whiting engineers, make this equipment adaptable to almost any foundry requirements. A Whiting representative will gladly call to discuss it with you.

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